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ABSTRACT

The major goal of the project was to modify the competency-based medical curriculum of the Southern Illinois University School of Medicine so that essential competencies are identified and mechanisms are established to ensure that students not only learn but retain and integrate these competencies. The specific objectives of the Competency Maintenance Project were to: (1) design a blueprint for the system; (2) develop a strategy for identifying the critically important competencies to be reflected in the maintenance objectives; (3) determine the maintenance objectives for the first year of the program; (4) design and implement experimentally in one curriculum block a system for student rehearsal of maintenance competencies; and (5) design and implement experimentally a set of assessment procedures for retention of the first-year competencies. The accomplishments of the project to date are described, illustrated with many samples of materials used. (MSE)

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FINAL REPORT

COMPETENCY MAINTENANCE SYSTEM PROJECT

SOUTHERN ILLINOIS UNIVERSITY SCHOOL OF MEDICINE

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Supported by Grant Number G007502225 from the
Fund for the Improvement of Post Secondary Education
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Prepared by
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Associate Professor and Project Director

November 30, 1976

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Sermon...

There is a growing suspicion among a number of students that the passing of goals and modules, though officially recommended, may not lead to the ultimate personal and professional satisfaction. The repeated use of the shortest of short-term memory is encouraged by the module system and, as we learned in Neuro (didn't we?), this doesn't lead inevitably to retention. The big guys are concerned about this rather obvious fact, but its obvious corollary has only recently begun to dawn on some of us: how much we ultimately know is really up to us, passed modules notwithstanding.

-- R.W.

A statement written by Rob Wilson (S.I.U. School of Medicine Class of 1978) for Helpful Hints & True Facts; an unofficial publication written by the Class of 1978 as advice to the Class of 1979.

FINAL REPORT
COMPETENCY MAINTENANCE SYSTEM PROJECT G007502225
SOUTHERN ILLINOIS UNIVERSITY SCHOOL OF MEDICINE

Background Information on the
Southern Illinois University Medical Curriculum

The entire undergraduate medical curriculum of the Southern Illinois University School of Medicine has been competency-based since its inception in 1973. At S.I.U. School of Medicine the term competency-based or mastery-based means:

a) Competencies to be learned are predetermined and communicated to students, in advance of instruction, in the form of behavioral objectives;
b) Students compete against prespecified standards of acceptable performance, not against each other;
c) Students are given the opportunity to recycle (engage in remedial learning activities and retake exams) without penalty when they fail to meet prespecified standards the first time;
d) Students are given remedial instruction tailored to their deficiencies after each examination; and
e) Instruction (teaching + evaluation + feedback and remediation advice) is delivered in small units (modules) which require an average of ten hours of instruction and contain an average of eight objectives per module.

The objectives were written by instructional teams each composed of medical faculty (M.D.'s and basic scientists), practicing (non-academic) physicians and at least one instructional designer. The committees were carefully and continually coached to insure that each objective was relevant to the practice of medicine. Figure One indicates one tool used to accomplish this.

The objectives are organized into curriculum units of varying size. The five components of the instructional curriculum from

the largest to smallest include: the entire thirty-six-month program; the Sequences I, II, III and IV; the blocks (e.g., organ systems and clerkships); the problem units (five to fifteen for each organ system); and the modules (approximately five per problem unit and 1,000 in total). Each module presents a rationale explaining the need for each competency, the objectives, suggested learning experiences, suggested learning resources and procedures for evaluating student achievement of objectives. Figures Two and Three depict the organizational structure of the curriculum.

More information regarding organization and implementation of the Southern Illinois University undergraduate medical curriculum is presented in Appendix One.

Regardless of how carefully one designs and develops the initial modules, it is impossible to build a curriculum which initially considers all factors it should. Although composed of individuals representing multiple perspectives, instructional teams had to concentrate on building their own curricular materials without the benefit of seeing what other teams were including in their blocks. Therefore, efforts to build curricular materials which insure student integration and retention of important competencies were hampered. Further, the teams were working under serious time pressures and were unable to spend as much time as they would have liked in deciding the relative importance of competencies which were included. Therefore, some very important competencies may have been excluded and other fairly trivial competencies may have been included.

Since the time of initial development, each block has been used with at least three classes of students. After each class finishes a block, the modules are revised by module authors using module evaluation data collected from that class. Of course module authors are specialists and as a result may overemphasize certain esoteric competencies and underemphasize important rudimentary competencies

Figure One

STRATEGY FOR DEVELOPING TERMINAL AND ENROUTE GOALS FOR DIAGNOSIS-PRESCRIPTION-THERAPY PROCESS FOR ORGAN SYSTEMS

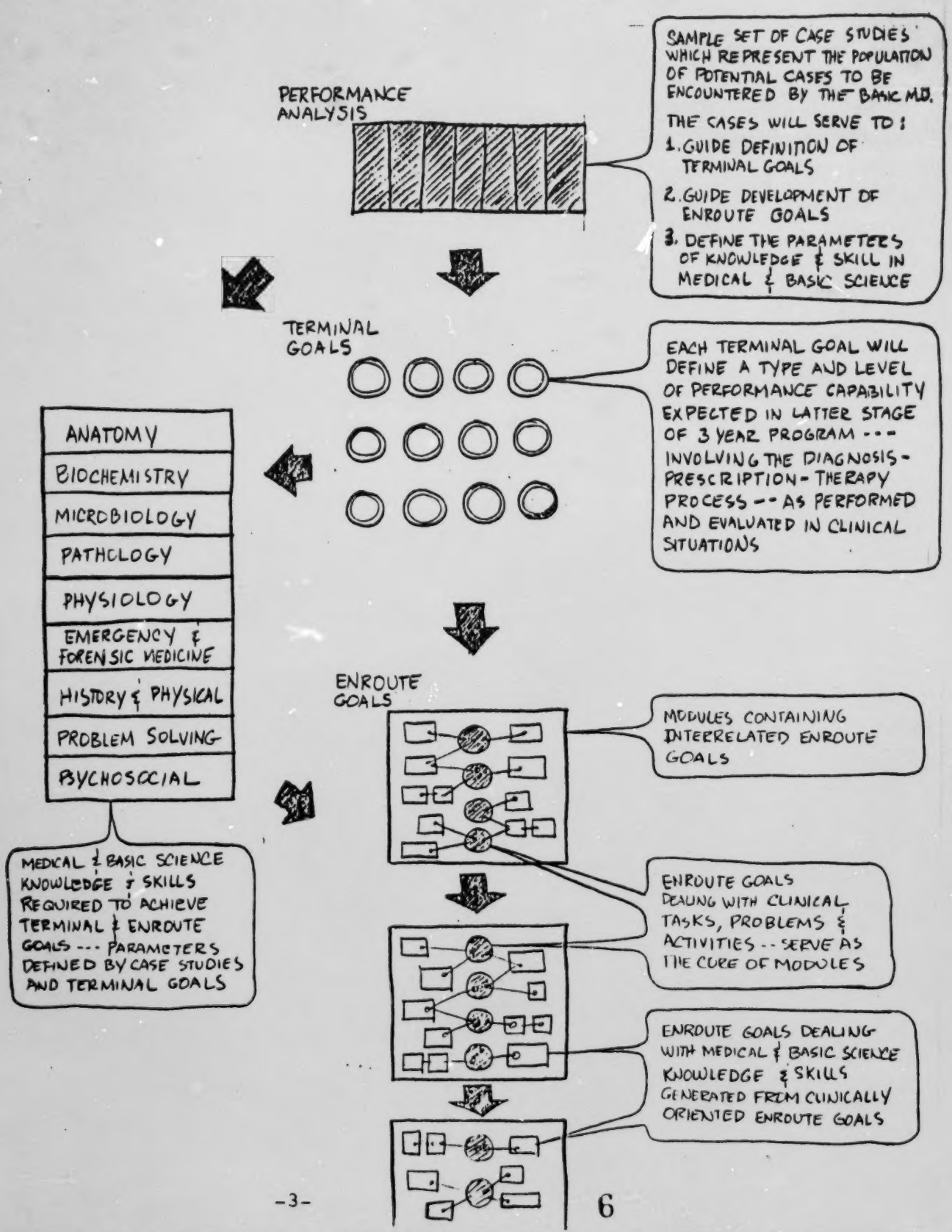
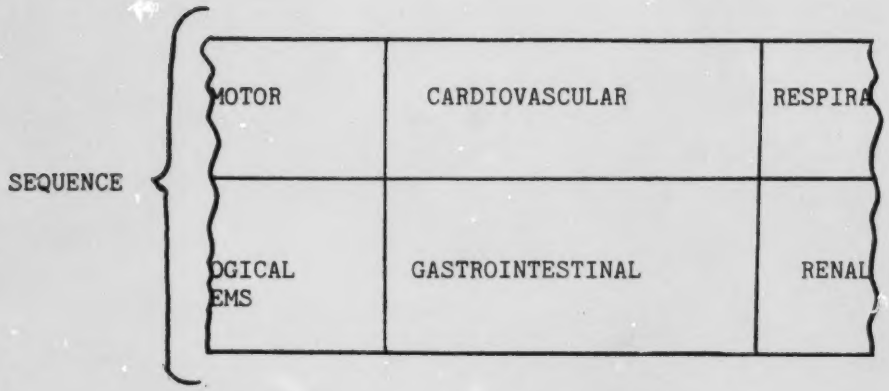
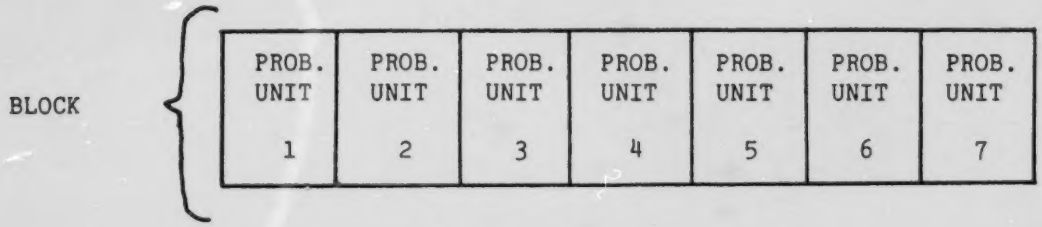

PERFORMANCE ANALYSIS
SAMPLE SET OF CASE STUDIES WHICH REPRESENT THE POPULATION OF POTENTIAL CASES TO BE ENCOUNTERED BY THE BASIC M.D.
THE CASES WILL SERVE TO:
1. GUIDE DEFINITION OF TERMINAL GOALS
2. GUIDE DEVELOPMENT OF ENROUTE GOALS
3. DEFINE THE PARAMETERS OF KNOWLEDGE & SKILL IN MEDICAL & BASIC SCIENCE
TERMINAL GOALS
EACH TERMINAL GOAL WILL DEFINE A TYPE AND LEVEL OF PERFORMANCE CAPABILITY EXPECTED IN LATTER STAGE OF 3 YEAR PROGRAM --- INVOLVING THE DIAGNOSIS-PRESCRIPTION-THERAPY PROCESS -- AS PERFORMED AND EVALUATED IN CLINICAL SITUATIONS
ANATOMY
BIOCHEMISTRY
MICROBIOLOGY
PATHOLOGY
PHYSIOLOGY
EMERGENCY & FORENSIC MEDICINE
HISTORY & PHYSICAL
PROBLEM SOLVING
PSYCHOSOCIAL
MEDICAL & BASIC SCIENCE KNOWLEDGE & SKILLS REQUIRED TO ACHIEVE TERMINAL & ENROUTE GOALS --- PARAMETERS DEFINED BY CASE STUDIES AND TERMINAL GOALS
ENROUTE GOALS
MODULES CONTAINING INTERRELATED ENROUTE GOALS
ENROUTE GOALS DEALING WITH CLINICAL TASKS, PROBLEMS & ACTIVITIES -- SERVE AS THE CORE OF MODULES
ENROUTE GOALS DEALING WITH MEDICAL & BASIC SCIENCE KNOWLEDGE & SKILLS GENERATED FROM CLINICALLY ORIENTED ENROUTE GOALS

Figure Two

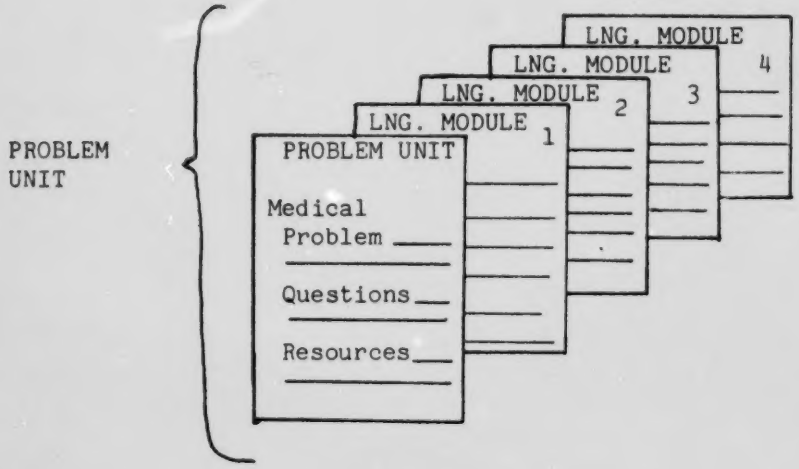
FOUR COMPONENTS OF THE INSTRUCTIONAL PROGRAM



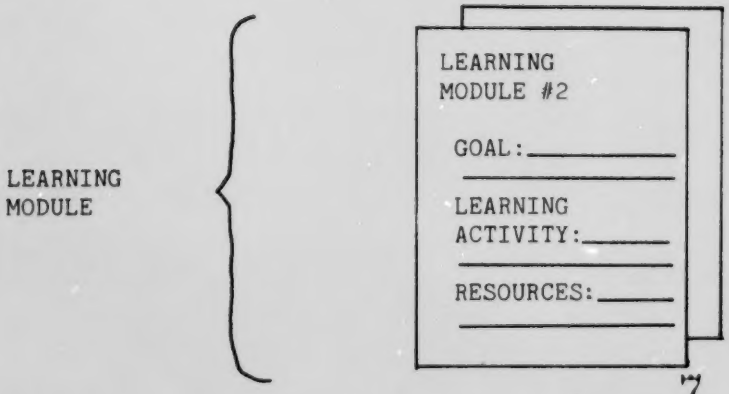
Sequence I is composed of 16 blocks



As an example, the G.I. block might be organized into 7 problem units



This exemplary problem unit has 4 learning modules plus the problem unit goal statement



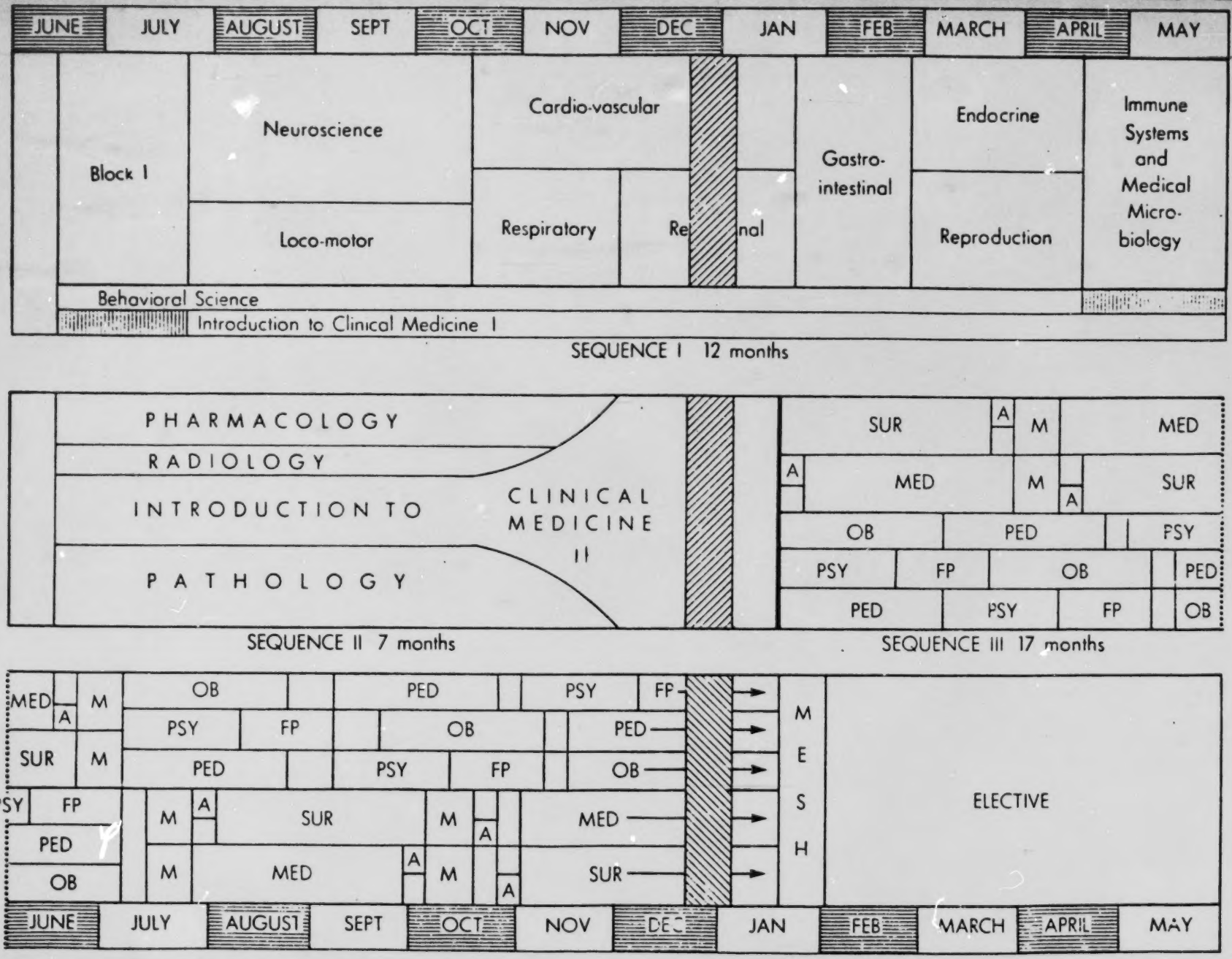


Figure Three

in their revisions. Thus, the modules may be evolving away from teaching competencies which all practitioners agree are essential and toward a more direct reflection of the module author's specialized interests. Therefore, a system is needed for evaluating and updating modular objectives which insures that the objectives selected reflect those competencies deemed important by a majority of practitioners--not by a single specialty or specialist.

Objectives of the Competency Maintenance System Project

The major goal of this project is to modify the medical curriculum of the S.I.U. School of Medicine so that essential competencies are identified and mechanisms are established to insure that students not only learn but retain and integrate these competencies with other essential competencies. The general strategy for doing so was as follows: 1) Opinions of basic science faculty, clinical faculty, advanced students, and practicing physicians are secured regarding the degree of retention necessary for each objective; 2) Rehearsal activities are being built into the curriculum to aid student retention and integration of essential competencies; and 3) Assessment procedures are being established which require retention and integration of essential competencies, as well as acquisition of all curricular competencies as a condition for promotion.

The objectives for the Competency Maintenance Project were to: 1) Design an overall blueprint for the competency maintenance system; 2) Develop a strategy for identifying the critically important competencies to be reflected in the maintenance objectives; 3) Determine the maintenance objectives for the first year of the program, hereafter called Sequence I; 4) Design and implement on a pilot basis in one curriculum block a system for stimulating student rehearsal of maintenance competencies; and 5) Design and implement on a pilot basis in Sequence I a set of assessment procedures which test students for satisfactory retention of essential competencies prior to certifying students for promotion.

The remainder of this report describes the accomplishments of this project. The report not only includes the ultimate products described above, but includes: a) products of interim steps which might be useful to other institutions, b) descriptions of the processes utilized, and c) available data regarding the usefulness of the system (evaluation data).

Overall Blueprint for Competency Maintenance System

Initial efforts led to agreements that, to be effective, the competency maintenance system should:

1) Cause students to review important material learned earlier;
2) Cause students to integrate competencies originally learned in isolation as a result of being taught in modules separated in time;
3) Cause students to practice applying previously learned competencies to unfamiliar cases;
4) Measure students' proficiency in integrating and applying previously learned competencies;
5) Be consistent with the competency-based philosophy of the school. Therefore, the competency maintenance system should inform students in advance of the competencies which they must demonstrate at the end of each instructional block;
6) Be consistent with learning theory and research in its attempts to facilitate student retention, integration and application; and
7) Be consistent with measurement theory in its attempts to measure validly the maintenance competencies.

Based on these specifications a system has been developed. The system provides a basic framework and set of guidelines for use by faculty. It is expected that individual instructional teams will and should adapt this framework to fit the particular idiosyncrasies of their instructional blocks. The remainder of this section

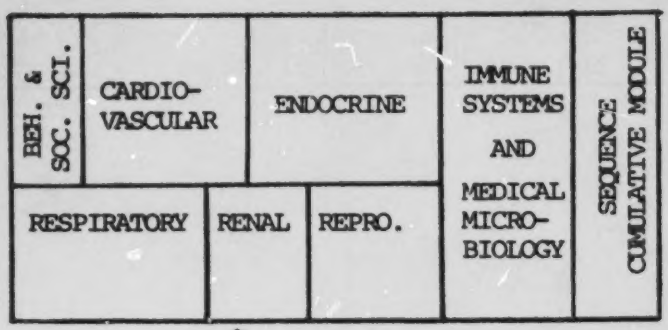
describes the components which will be added to the curriculum to achieve the goals of the competency maintenance project. Figure Four schematically illustrates the components of the competency maintenance system as they will be applied in Sequence I. Studying Figure Four now should aid you in understanding the remainder of this section. Also, Appendix Two contains the Cumulative Modules, rehearsal activities, and evaluation instruments prepared and used in the Neuroscience block this year. More will be said about this model block later, but referring to it now may help you understand the system described here.

Once competencies to be maintained have been agreed upon and maintenance objectives have been written to describe these competencies, each instructional team will construct at least one cumulative module to be disseminated to students with other curricular materials for that unit (block or sequence). The cumulative module will include all of the maintenace objectives for the unit and a set of instructions regarding how, when and where students will be evaluated over these objectives. Ideally the cumulative module will also include a set of practice activities for each goal with a mechanism for student self-evaluation. This will provide students a means for checking their competence and governing their study. (The Neuroscience block currently does not contain this feature).

After completion of the unit, students will be tested over the maintenance objectives in the cumulative module. For the most part the tests will require student integration of previously learned material and application of that material to the solution of problems posed in previously unseen cases. In other cases, the student will demonstrate a procedure which will be evaluated by a faculty member using a check list or rating scale. Rarely would the student be asked to demonstrate only memory for specific facts. Normally, the student would at least be asked to apply those facts in dealing with a realistic problem. Figure Five is a definition/description of cumulative objectives used to aid faculty in preparing the

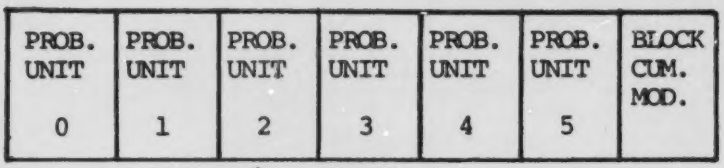
Figure Four

SEQUENCE I- composed of 16 blocks Plus the Sequence Cumulative Module



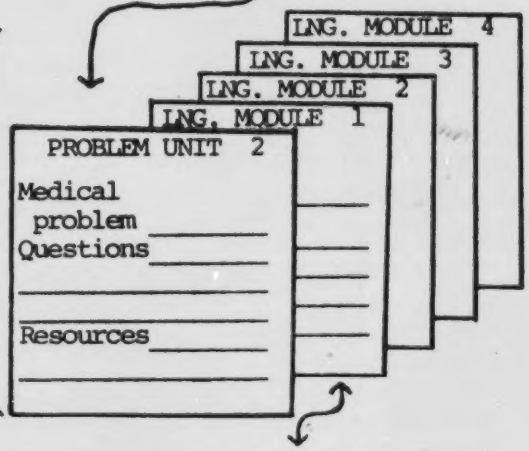
The sequence cumulative module tests students' mastery of sequence maintenance objectives. Students must satisfactorily complete all blocks and the sequence cumulative module in order to be promoted to Sequence II.

BLOCK



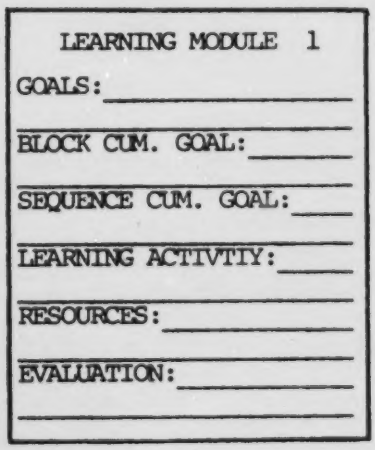
As an example, the RENAL block is organized into six problem units plus the block cumulative module. The block cumulative module tests students' mastery of block maintenance objectives. Students must satisfactorily complete all problem units and the block cumulative module.

PROBLEM UNIT



This exemplary problem unit has 4 learning modules plus the problem unit goal statement.

LEARNING MODULE



In this example, learning module #1 for the Renal block contains: 1) the module goals; 2) a Block cumulative goal; 3) a Sequence cumulative goal; 4) the learning activities that will achieve the goals; 5) resources to attain module goals; and 6) evaluation procedures used to measure goal mastery. Students will be tested over the cumulative goals at the same time they are tested over the module goals. However, their performance on the cumulative goals will not influence their academic progress at this time. Cumulative goals are instructional activities designed to provide students with practice exercises over important objectives, feedback regarding their level of competence at that time and suggestions for remediating weaknesses which are discovered in this process.

Figure Five

DEFINITION OF A CUMULATIVE OBJECTIVE

A CUMULATIVE OBJECTIVE SHOULD DO THREE THINGS:

1. PROVIDE STUDENTS WITH OPPORTUNITIES TO PRACTICE IMPORTANT COMPETENCIES LEARNED EARLIER;
2. REQUIRE STUDENTS TO PUT TOGETHER IMPORTANT COMPETENCIES WHICH THEY HAVE NOT PREVIOUSLY INTEGRATED;
3. REQUIRE APPLICATION OF THE INTEGRATED INFORMATION TO THE SOLUTION OF SOME PREVIOUSLY UNENCOUNTERED PROBLEM OR IN AN UNENCOUNTERED SITUATION.

PREFERABLY THE OBJECTIVE WILL BE CASE ORIENTED (I.E., GIVEN PATIENT DATA, DO X) SO THAT IT APPROXIMATES THE FORM OF ACTUAL DEMANDS PLACED ON PHYSICIANS. A CUMULATIVE OBJECTIVE EMPHASIZES THE SOLUTION PROCESS RATHER THAN THE RECALL OF FACTS. UNLESS THE OBJECTIVE STATES THAT NECESSARY FACTS WILL BE GIVEN, STUDENTS WILL BE EXPECTED TO POSSESS NECESSARY FACTS TO SHOW MASTERY OF THE CUMULATIVE OBJECTIVE.

cumulative objectives for each curriculum block.

Failure to demonstrate retention of any maintenance competency will result in an appropriate recycling requirement. This process will continue until the student demonstrates acceptable mastery of all maintenance objectives.

As indicated above, the student will be provided cumulative objectives describing the competencies to be maintained at the beginning of each block or sequence. Ideally this will be presented in the form of an orienting module printed as the first module for a block. This module will include all cumulative objectives for that block in a form designed to help students organize their thinking and studying to facilitate achievement of the necessary retention and integration during the process of completing regular instructional modules. The second alternative is to simply inform students about the cumulative modules and refer them to the modules as a substitute for the orienting module (as is done presently in the Neuroscience block). The key point in either case is that the only thing students do not know when they present themselves for evaluation over a cumulative module is the specific application of the competency that they will have to make. For example, with a maintenance objective that states: "Given a medical sign or symptom, the student will describe all sites where a lesion might exist that would cause that sign or symptom and will give a sound physiological explanation as to how a lesion in each site could cause the resultant symptom," students know in advance that the test will require the ability to identify lesion sites which might cause a symptom. What they do not know is what symptom or symptoms will be presented.

To aid students in retaining the maintenance competencies, maintenance objectives will be built into existing modules at judiciously selected points throughout the instructional block to serve as rehearsal activities. Students will know these as cumulative objectives or cumulative goals.

The maintenance competencies represented by the cumulative objectives will be tested and scored along with module competencies when the student is evaluated over the module. Failure to demonstrate competency at this point will neither prevent students from proceeding to the next module nor cause them to recycle. The purposes for introducing maintenance objectives in modules are to provide students with opportunities to rehearse previously learned maintenance competencies, to give students feedback regarding their level of competence at that time and to provide remediation when desirable.

As envisioned, the system would include block cumulative objectives interspersed throughout each instructional block and sequence cumulative objectives interspersed throughout all blocks. Thus, a student working on a module in the third instructional block may be faced with regular module objectives, with a block cumulative objective covering material learned earlier in that block and with a sequence cumulative objective covering material learned in the first and second blocks. The students do not have to demonstrate mastery on the cumulative objectives at this time, but they do find out where they stand on those competencies. They also know that they must demonstrate those competencies in the cumulative module at the end of the instructional unit.

The concept of cumulative objectives takes advantage of the psychological principle that spaced practice of competencies leads to a longer period of retention for those competencies. Moreover, the use of cumulative objectives offers other learning benefits. Due to constraints of time, competencies are often learned in isolation from other closely related competencies. By writing maintenance objectives in such a way that students are required to see the relationship between two or more competencies learned in isolation, it is possible to move students toward mastery of the patterns of knowledge and the complex skills which are the corpus of functional knowledge. In addition, requiring students to apply this knowledge to a number of unique situations which differ from each other in important ways, should increase the students' ability to make effective use of their knowledge.

Advantages and disadvantages of the system described are presented below. In each case they reflect the positive and negative effects of the system from three viewpoints: that of learning theory, measurement theory and educational theory.

Advantages

Learning:

1) The System causes spaced practice of important competencies on part of students.
2) It emphasizes application of competencies to a variety of cases, situations, etc.

Measurement:

1) The objectives provide a generic frame for exam. Cases can easily be changed to insure that students learn competencies rather than memorize answers.
2) The System offers more flexible exam types than standard and allows for questions of higher taxonomic levels. It further encourages evaluation of problem solving.
3) It encourages faculty to write questions at higher taxonomic levels since they know students have access to the maintenance objectives.

Educational:

1) The System remains consistent with the competency-based philosophy. There is no hidden agenda. The students are provided with maintenance objectives in advance.
2) It is consistent with the focus on clinical relevance.
3) The lack of a hidden agenda maximizes positive attitudes and motivation of students.

Disadvantages

Learning:

The System could possibly place too much emphasis on maintenance objectives at the expense of other modular objectives. This situation should be countered by the normal requirement of all competency-based systems that students demonstrate competence on module objectives before progressing to other modules.

Measurement:

1) Greater time and manpower for scoring non-objective test responses may be required. Careful planning of examinations should control this problem.
2) A possible lack of agreement between independent evaluations of student answers might exist. This can be controlled through careful formulation of questions and use of preplanned answer keys and scoring procedures.

Educational:

The System suggests no disadvantages from an educational theoretical point of view.

Strategy for Identifying Critically Important Competencies

Defining the maintenance objectives is of major importance in implementing this competency maintenance strategy. The procedure used must identify from the essential competencies to be retained from the curriculum and should remain sensitive to the level of maintenance required for these competencies.

First, a survey of the literature was conducted to determine strategies which have been or could be used in establishing objectives for instruction. Appendix Three summarizes the characteristics of each procedure. Strategies reviewed fell into two broad categories: opinion-based and observation-based.

Opinion-based procedures typically ask specialists to set priorities among a set of previously written statements (e.g., list of topics, objectives, content outline) which in some way describe the content proposed for inclusion in the curriculum. These procedures rely on the experiences, background, perceptions and memory of the specialists to produce a valid set of priorities. Selective memory of the specialists as a function of their present responsibilities sometimes leads to overemphasis of esoteric skills and underemphasis of

important rudimentary skills. Additionally, the exhaustiveness of the list of skills is dependent on the care with which the initial list of competencies is prepared.

Observation-based processes would identify maintenance competencies by careful observations of physician activities. Generally, these observations take place at the time the physician activities occur. However, some strategies provide for the recording of observations "after the fact." When this is true, observation-based processes share the problem of selective memory with the opinion-based procedures. However, the major problem with observation-based procedures lies in insuring that a representative sample of physicians are observed in collecting the data. Also, the cost of using observation-based procedures is typically much higher than for opinion-based procedures. Further, since observation-based procedures call for the creation of a list of competencies rather than rating an existing list, the percentage of specialists who complete the task is normally quite low unless they can be paid for their efforts.

Since the S.I.U. medical curriculum was already in the form of written behavioral objectives, and since these objectives serve as a ready-made list of statements to be rated by specialists, it was decided to rely primarily on a survey questionnaire procedure for preliminary establishment of priorities of objectives. This procedure required relatively little time on the part of raters and, therefore, allowed the input of many individuals with differing perspectives at a relatively small cost. Likewise, it allowed for input from all members of the faculty. Since faculty members actually deliver the curriculum, their opinions and involvement in setting the priorities are essential. The desires of the faculty become the curriculum regardless of how that curriculum is represented on paper.

The questionnaire and cover letter used are included as Appendix Four. These were sent with the objectives from a set of Sequence I modules to all basic science faculty, clinical faculty, advanced students (Sequences II and III) and residents. These four groups

provide a variety of perspectives in rating the importance for maintenance of each objective. Basic science faculty teach the Sequence I curriculum and, as specialists, are aware of recent developments in their fields. Furthermore, they generally have a greater understanding and knowledge of the specific content represented by the Sequence I objectives than do the other groups. Clinical faculty who teach Sequences II and III are best prepared to recognize competencies needed for success in those sequences. Also, as practicing physicians, they can rate Sequence I competencies in terms of importance for effective practice of medicine. Advanced standing students are in an ideal position to relate the demands of their current sequence to the competencies required in Sequence I. Residents are practicing clinicians, yet have completed their undergraduate medical training recently enough to be informed on new findings and procedures. Additionally, many residents also provide the perspective of being able to compare the goals of Sequence I with goals from other medical schools. Every Sequence I module is being rated by two representatives of each of the four groups--making a total of eight ratings per module. Basic science faculty rated modules they authored and others in their area of expertise. Clinical faculty, advanced standing students and residents rated modules which were randomly assigned to them. Basic science faculty rated the objectives from approximately 15 modules each (or 120 objectives) while the other groups rated objectives from an average of eight modules (or 64 objectives).

Questionnaire materials were sent to all raters by February 5th. By February 24th, 58% had completed their ratings and returned the materials without benefit of a reminder. By April 12th, after one reminder, 59% had returned their ratings. However, this figure is depressed dramatically by the 16% return rate of residents and the 39% return rate of unpaid clinical associates (community physicians who volunteer their time as teaching faculty). Without these two groups the percent return was 80%. Figure Six gives a breakdown of returns by subgroups. Future efforts in this area must focus on

Figure Six

PERCENTAGE RETURN OF OBJECTIVES
RATINGS BY EACH SUBGROUP

Basic Science Faculty	$\frac{75}{84}$	=	89%
*Clinical Faculty	$\frac{51}{72}$	=	70%
Advanced Students	$\frac{60}{94}$	=	63%
Residents	$\frac{10}{62}$	=	16%

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*Clinical Faculty

Full Time	$\frac{40}{44}$	=	90%
Clinical Associates	$\frac{11}{28}$	=	39%

on increasing the return rate from residents and clinical associates (individuals with relatively low vested interests in the outcomes) or finding alternate sources of information. On the other hand, our experience suggests that this is a very practical strategy for use in validating objectives when used with regular faculty and students. An 80% return rate is quite good since the task required an average of two and one-half hours on the part of each individual. This finding suggests that the task was perceived as a productive one by full time faculty and students. The following paragraphs describe the results of the rating process.

Appendix Five includes an example print-out of rater responses for one module, plus a key for interpreting the print-out. In addition, one complete print-out of rater responses to all modules has been submitted. If all ratings were received, the print-out should contain eight individual ratings for each objective in each module. The computer summary provides an average rating for each objective, individual ratings and information regarding the individual raters who provided each rating.

Inspection of the ratings print-out suggests that the rating process was successful. First, all rating categories were used, indicating that each category is realistic (has applications). Second, the ratings results for objectives within modules differ widely. This finding suggests that raters read each objective carefully and assigned ratings accordingly. There was some early apprehension on our part that raters might take the task less seriously and assign ratings for objectives solely on the module topic. If this had been the case, we would have expected less variability in ratings for objectives within modules.

Some other general observations about the objectives ratings outcomes can be made. First, there was a fairly high level of agreement among raters regarding the "proper" classification of objectives. In most cases where disagreement occurs, a large majority of the

ratings fall into adjacent categories (i.e., A's and B's or B's and C's, etc.) rather than into more discrepant categories. Furthermore, where disagreement occurs it is not along specialty lines. Neuroanatomists are as likely to disagree with each other as they are to disagree with pediatricians. Basic scientists disagree among themselves as much as they disagree with clinicians (M.D.'s). Faculty are as likely to agree with students as they are to agree with each other. The only discernible pattern is that module authors tended to rate their own objectives more severely than did other raters.

Ancedotal evidence suggests that faculty have used the ratings of objectives not only in the process of creating their cumulative objectives but also in the yearly analysis and revision of their teaching modules.

Creation of Cumulative
Objectives for Sequence One

This section deals with the process used in creating the cumulative objectives for each instructional block and a description of the outcomes, including the cumulative objectives themselves and various reactions to them.

When the initial proposal was written, we were thinking solely in terms of retention. The proposal referred to maintenance objectives and the plan was to identify those competencies taught which should be retained at least until the end of Sequence One.

Very early in our planning it became apparent that what we had envisioned as a clear-cut, simple process was neither clear-cut nor simple. The first major obstacle (or break-through, if you like) was when we realized that it was not a question of retain or not retain in most cases, but a question as to the form in which learned information should be retained. In some cases it is important for the student to be able to retain the competency in its originally learned form and

detail, in other cases only the main idea need be retained and in still other cases the student need only remember the existence of the body of knowledge so that it can be retrieved from books when needed. It was this realization which led to the categories for rating objectives as presented in Appendix Four. This realization also contributed to the decision to include integration and application in addition to retention as project goals. The decision to integrate some competency with another usually incorporates the process of deciding what form of retention is important for that competency. Thus, a critical shift in program outcomes occurred and the definition of a cumulative objective (presented earlier as Figure Five) was derived.

The definition of a cumulative objective presented in Figure Five was created for use by teaching faculty in developing cumulative objectives. In addition, a taxonomy of objectives with the same purpose as Bloom's taxonomy (1956) was prepared by Reed Williams as a tool for the instructional designers helping faculty in creating cumulative objectives. The taxonomy is included as Appendix Six. This taxonomy was designed for use in a behavioral objectives oriented curriculum. But, more importantly, it was designed with the intention of overcoming the major problem in using Bloom's taxonomy; lack of clarity in category descriptions leading to lack of agreement in assignment of objectives to categories.

The categories in Bloom's taxonomy are described in terms of non-observable mental events. Therefore, it is no surprise that individuals using the taxonomy often have trouble agreeing on the classification of any particular objective. The taxonomy devised for this project defines each category in terms of the characteristics an objective must possess to be classified into any category. As with objectives the taxonomy specifies: a) the conditions under which students must perform (i.e., nature of the task to which the student must respond and the tools which may be used), b) the behaviors which students must demonstrate; and c) the quality of response which is acceptable (standards or criteria of acceptable performance). With

this approach, objectives are classified based on observable properties of the objectives rather than on inferences about the mental events they stimulate.

Preliminary results suggest that the taxonomy overcomes the reliability problem. Two individuals were given the taxonomy and asked to identify objectives which fit each taxonomic category. They identified the examples included with the taxonomy in Appendix Six. In only one case did the author of the taxonomy disagree with the classification by the individuals who picked out the examples. More comprehensive and systematic tests of the taxonomy are underway. Preliminary data suggest that this may be a very important spinoff of the Competency Maintenance project.

As expected, the process of developing the cumulative objectives for each block differed with the personalities involved. However, the following paragraphs describe the general strategy used by project personnel in assisting teaching faculty to produce cumulative objectives for their instructional blocks.

As with all other curriculum development efforts in the S.I.U. School of Medicine, the strategy was to start working with the block coordinator. Then other members of the instructional team were brought into the process as directed by the block coordinator. Generally speaking, the block coordinators chose to develop the initial draft of the cumulative objectives independently and submit the draft to other members of the instructional team for suggested revisions. In some cases (Reproductive Block) one other member of the instructional team was involved in the initial drafting. In other cases (Behavioral Sciences) it was necessary to involve a number of other instructional team members. In all cases where this was done, each individual was given a separate section to draft rather than being asked to jointly draft cumulative objectives with other instructional team members.

After the pilot effort it was clear that the process of creating

a small number (5-10) of cumulative objectives covering an entire instructional block was easier than the process of creating a larger number. Therefore, we decided to orient block representatives to create cumulative objectives representing those competencies which students should still be able to demonstrate at the end of the sequence. The coordinator involved in the pilot also felt that such an approach would be more tractable in a socio-policial sense. He felt that efforts would then be perceived as addressed to improving the sequence as a whole rather than telling coordinators how to organize and run their blocks. The coordinator indicated that he personally intended to add to this nucleus and create a larger set of objectives which would govern development of an end of block examination. He felt this would be a relatively easy task once the original cumulative objectives were completed.

The first meeting with instructional block representatives entailed a four to six hour session. Representatives were told that the terminal goal for these sessions was to write five to ten cumulative objectives which represent those block competencies students should be able to demonstrate at the end of the sequence. Representatives were told this did not imply that any objectives presently included in modules were inappropriate. Rather the plan was to identify the "big ideas" learned during the block; those ideas and skills which students would find occasion to apply frequently over many years. Also, we indicated that these would likely be the five to ten ideas around which most block objectives could be organized. At this point we handed out the definition of a cumulative objective, discussed the characteristics described and stressed that the cumulative objectives should require the use of knowledge, not just its possession.

The second step in the process of writing cumulative objectives was to have the block representative identify a number of themes or big ideas around which the contents of the block could be organized. In the case of the Reproductive Block these themes were 1) Sexual Development in the Pre-Reproductive, Reproductive and Post-Reproductive years; 2) Pregnancy; 3) Infertility; and 4) Contraception. Each

major theme was then elaborated with subcategories. The coordinator of the Reproductive Block included the following as some of the subcategories under the major theme, Pregnancy: 1) Sexual Behavior, 2) Sperm Deposit, 3) Sperm Transport, and 4) Ova Implantation. These categories and subcategories then went through a number of cycles where they were challenged and subsequently revised until the block representative was satisfied that the list of themes provided adequate coverage of the block material. At this point the block coordinator was asked to assign relative weights to each category by distributing 100 percentage points among the categories. This second step usually required three to five hours.

The stage was thus set to begin building cumulative objectives. The block representative was asked to pick one category for which he/she and the project instructional development specialists would jointly build cumulative objectives. Presumably, after working through the process once with an instructional development specialist, the block representative would be able to independently draft the objectives for the remaining categories. The process of constructing objectives began with the block representative describing what tasks could be set for the student to test the student's understanding of the "big ideas" represented under each major topic.

Once the coordinator had identified the tasks in rough form, he/she was assisted in converting the task descriptions to objectives form by the question: "In an objective, what information must be given and what must the student be required to do in order to determine the student's understanding and ability to apply the organizing idea?" At this point some common givens and some common behaviors from higher level objectives were supplied. The block representative was also assisted in the actual formulation of objectives for the selected topic. Additional efforts were made to aid the block representative in discriminating between recall and thought level objectives. Often this was accomplished by creating more than one objective covering the same idea, but each requiring a different type of thinking. This process took two to four hours.

Once the block representative felt somewhat comfortable with the objectives produced for the selected topic, and once all questions had been answered, the block representative was instructed to prepare objectives covering the other topics on her/his own. It was suggested that the objectives just produced and the process used might serve as models for the remainder of the task. In some cases, written materials reiterating the steps leading from the topics to objectives were provided. In all cases, the topic list itself and the definition of a cumulative objective were available to the block representative.

After independently completing a draft of the objectives for the remaining topics, the block representative forwarded a copy of the draft objectives to the instructioanl development specialists(s) involved. The instructional development specialists independently reviewed and revised the draft objectives. Example copies of an initial draft of objectives by a block representative and the revised set of objectives prepared by instructional development specialists are included as Appendix Seven. The revision process itself required the instructional development specialists to seek clarification of objectives in order to make revisions. The focus of the revision process by instructional development specialists was not only to clarify objectives and improve their technical form, but also to raise the level of thinking required by each objective. This was not to say that all objectives should necessarily tap higher level thinking. Rather it was to provide an alternative set of objectives for the block representative to contemplate.

Once the alternative objectives were prepared, a meeting was called to discuss the two sets of objectives with the block representative. The representative was asked to review her/his own draft objective and compare it to the draft prepared by instructional development specialists. He/she was not necessarily expected to choose between the two. Often a third alternative emerged from discussion of the two initial drafts. We found that dealing in concrete alternatives was usually a more effective strategy than trying to discuss and improve the block representative's draft objectives in a face-to-face setting. However, it was critical that the block representative

saw this stage as offering alternatives to stimulate discussion rather than trying to influence her/his content decisions.

Cumulative objectives have been completed for all Sequence One blocks except Cardiovascular and Block One. Creation of Cardiovascular block cumulative objectives is requiring a great deal more time than any other block required and efforts are continuing. Block One cumulative objectives will be completed after the Cardiovascular cumulative objectives are completed, as the individuals involved are also scheduled to review all cumulative objectives to insure that critical genetics and biochemistry competencies are included.

After cumulative objectives had been completed, they were reviewed and concrete suggestions for further improvement were made by Donald A. Bosshart, Associate Director of the Office of Research in Medical Education at the University of Texas Medical Branch at Galveston. Dr. Bosshart read each objective and proposed needed modifications. Where appropriate, these modifications were incorporated into the cumulative objectives. In addition, Dr. Bosshart prepared two communications dealing with more general concerns. These are included as Appendix Eight. In some cases, problems identified have been resolved; in other cases they have been noted for future consideration.

Appendix Nine includes cumulative objectives for Sequence One instructional blocks as they stand after all development and revision cycles described above have been completed. Virtually all blocks have included some case-oriented application level cumulative objectives. In many blocks this type objective constitutes a majority of the cumulative objectives. In some, virtually all objectives are case-oriented.

In all blocks a great deal of effort has been expended in the production and revision of cumulative objectives and the faculty are pleased with the outcome. Of course, they expect to revise the cumulative objectives based on experience just as they do with all teaching objectives.

Pilot Testing of the Competency Maintenance System in the Neuroscience Block

To test the concepts underlying the Competency Maintenance System, we built rehearsal activities and two cumulative modules into the Neuroscience block of Sequence One. We also built examinations to test student achievement of the objectives in the two cumulative modules. The rehearsal activities, referred to as cumulative goals; the two cumulative modules and the examination key for Cumulative Module II are included as Appendix Two.

As planned, the rehearsal activities are simply objectives requiring integration and rehearsal of previously learned material. These cumulative goals are included with other objectives in regular Neuroscience modules. See page 64 for the first rehearsal activity and the introduction of cumulative goals as presented to students. As indicated in the introduction to cumulative goals, students were tested over the cumulative goals when they were tested over other module objectives. Contrary to our original plans, performance on these cumulative goals did influence whether the student passed the module or not. Faculty were concerned that students would not prepare for the evaluation over cumulative goals if their performance did not "count." Therefore, a token scoring procedure was introduced to encourage some degree of student preparation and preserve the learning value of the rehearsal activities. The main focus of these rehearsal activities was still to encourage spaced practice and integration of previously learned competencies, to provide students with self-checks on the level of integration that was occurring and to provide an opportunity for remedial instruction by faculty when needed.

As indicated earlier, two cumulative modules were built into the Neuroscience block. Cumulative Module I starts on page 81 of this report and Cumulative Module II starts on page 93. Cumulative Module I was placed in the middle of the block and Cumulative Module II was placed at the end. These modules contained appropriate cumulative objectives for Neuroscience and served as blueprints for major

examinations. The module objectives specified the competencies that would be tested without revealing the actual content of the examination. A comparison of Cumulative Module II and the examination for that module will shed further light on the relationship between the two.

The Cumulative Module II examination included in this report is actually an answer key. The key was prepared, duplicated and returned to students with the results of their performance on the examination. In this way, it was hoped the test and feedback would also provide an important learning experience. As with any module or exam in a mastery based system, acceptable standards of performance were pre-established and students who initially failed to meet those standards were required to recycle until they did.

The key is included in the appendix (beginning on page 99) to demonstrate the degree of integration and the systematic means of scoring and reporting information back to students regarding their performance. The test is broken into four subtests. The basic science subtest covers important information learned in Neuroscience modules. Each item's designation on the left hand side of the page by Roman and Arabic numerals indicates the problem unit and module being tested. The clinical skills portion of the exam tests student mastery of important history and physical examination skills learned. The third subtest is comprised of a clinical case for which students are required to integrate and apply knowledge gained in various neuroscience modules in dealing with a series of questions organized around that case. The fourth section of the examination is labeled the "Cumulative Section." In this section the student is faced with tasks specifically designed to require the student to integrate selected previously learned material and to more independently organize, synthesize and report data.

The other information in the left margin adjacent to each question refers to the scoring of that item. "T" indicates the total possible points achievable on that question. "F" signifies the minimum passing score and stands for Fair. "S" stands for Superior and indicates superior performance in the minds of the faculty. A passing or failing score for any particular subtest is defined as a certain number of "F's" and/or "S's" on the questions associated with each subtest.

Neuroscience rehearsal activities, cumulative modules and examinations were prepared in time to be used by students this year. Some data is available regarding student performance on the exams and student attitudes toward block organization including the competency maintenance components. The following paragraphs provide pertinent information.

Figure Seven provides data regarding the portion of the class passing each cumulative module subtest on the first attempt. The results demonstrate some dramatic differences between performance on Cumulative Module I and Cumulative Module II. While only 49% passed Cumulative Module I on the first attempt, 84% passed Cumulative Module II the first time. Further, the differences in overall pass rates are primarily accounted for by improved performance on the Cumulative Module II Clinical Skills and Cumulative Questions subtest. These results suggest that lack of prior experience with integration level objectives may have hampered performance on Cumulative Module I, but the experience of preparing for and taking Cumulative Module I may have helped overcome this deficiency thus preparing the students better for Cumulative Module II.

* * * * * * * * * *

Figure Seven

PERCENTAGE OF STUDENTS PASSING
CUMULATIVE MODULE SUBTESTS ON FIRST ATTEMPT

Subtest	Cumulative Module I	Cumulative Module II
Basic Science	95%	95%
Clinical Skills	68%	100%
Clinical Case	82%	87%
Cumulative Questions	76%	100%
Total Test	49%	84%

* * * * * * * * * *

At the end of the Neuroscience block, students were polled to determine their reaction to the block including the cumulative goals, modules and examinations. The opinions ranged from neutral to very positive with a very few negative comments (a number that would be expected anytime 77 students are polled about anything). Some representative quotations from these student responses are included below:

Responses regarding overall organization of the block:

"Undoubtedly the best in the country"
"Remarkable job"
"Well thought out"
"Excellent"

Responses regarding the Cumulative Examination (Cumulative Module II):

"Fantastic learning experience"
"Satisfied with integration and coverage"
"Nice way to end. Brings a lot of ends together in a good thinking experience"
"Not enough emphasis on basic sciences"
"Results told what I didn't know and what I did have under control."

Major strengths of the Block:

"Organization"
"Integration between text material and clinical cases"
"Reinforcement (e.g., if you missed something in Module X you got it again in Module Y)"
"Good sequencing. Things fit together well."

The above comments suggest that students approve of the competency maintenance strategy. What about faculty? Ancedotal data collected by talking with faculty suggests that they perceive it as a natural next step in the development of the School of Medicine curriculum. Some were concerned that student attention to integration type objectives will take a lot of time, but felt that the cumulative objectives will probably displace some existing objectives that are of

marginal utility. In a Sequence One retreat, some faculty indicated a desire to elaborate the competency maintenance strategy by adding a new block at the end of Sequence One which would provide instruction designed to facilitate integration. Most faculty supported this idea in principle, but none is presently willing to give up time assigned to her/his block to make the integration block a reality. Apparently this idea will be batted around for awhile and may or may not get implemented. Nonetheless, the fact that it became a major topic of discussion at the Sequence One faculty retreat suggests the degree to which this type of thinking has been incorporated by the faculty. The project evaluation report (included as Appendix Ten) provides more data about faculty reaction to the competency maintenance strategy.

Plans for the Future

Since the pilot application suggests the competency maintenance system is practical, and since both faculty and students have received it well, the next implementation step is to develop cumulative modules and associated examinations to be used at the end of Sequence One. The sequence cumulative module will be based on the cumulative objectives already produced by block representatives and both the module and exam will be ready in time to be administered on a pilot basis at the end of this academic year (June).

Efficiency is one problem with the Cumulative Module examinations produced for use in the Neuroscience block. A tremendous number of work hours are required to score student examination papers. However, as indicated in the proposal, we are committed to testing the important competencies and will use whatever evaluation methodology is necessary. Nonetheless, we are investigating alternate evaluation mechansisms which have promise of achieving the desired quality of evaluation at less cost. Our major efforts to date have included surveying various evaluation methodologies and characterizing them in terms of the types of objectives each is most capable of assessing. Appendix Eleven provides a survey of assessment methodologies which grant personnel have

prepared in pursuing this goal. Now that the cumulative objectives are established and describe the competencies which must be assessed, we plan to begin experimenting with various cost saving assessment methods.

Efforts will also be addressed to assisting block coordinators in preparing rehearsal activities and cumulative modules for their respective blocks. Again, for the sake of efficiency, we must concentrate on building rehearsal activities and cumulative modules which do not demand an inordinate increase in faculty time devoted to teaching. Therefore, experimentation with more efficient strategies will play a significant role in our future efforts.

APPENDIX ONE

INSTITUTIONAL INFORMATION

Southern Illinois University School of Medicine conducts an around-the-calendar three-year program leading to the M.D. degree. The first twelve months of the program take place at the medical education facilities on the Carbondale campus, and the continuing twenty-four months of the program occur at the medical center in Springfield. This split campus organization allows the School of Medicine to maximally utilize existing resources of the eighteenth largest university in the U.S. and the long-established clinical facilities in Springfield--namely, Memorial Medical Center and St. John's Hospital. Additionally, this geographic structure strengthens the School of Medicine's commitment of academic support to physicians practicing medicine in all of central and southern Illinois, as well as allowing the School to incorporate these physicians into the various teaching programs of the School.

Although the program is divided geographically, the School of Medicine is philosophically committed to the concept of a unified, continuing curriculum. Charges of a lack of "relevance" frequently have been aimed at portions of traditional medical curricula. Keeping these charges in mind, the curriculum designers of the SIU School of Medicine have implemented a program whose central concern is to give the student the best organized set of useful information, skills and problem-solving strategies.

The entire undergraduate curriculum of the SIU School of Medicine is a fully functioning, competency-based system. The five components of the instructional program from largest to smallest are: the Program (this is the entire thirty-six months); the Sequence (Sequence I occurs

in Carbondale; Sequences II, III and IV are in Springfield); the Block (e.g., organ systems and clerkships); the Problem Unit (from five to fifteen per organ system); and the Module (about five modules for each problem unit). Each module contains an average of eight objectives. Modules also provide a rationale explaining the need for each competency, suggest methods of learning (learning experiences), learning material (learning resources) and procedures for evaluating student achievement of objectives.

The first year program is designed to give students competence in sciences basic to medicine such as Anatomy, Physiology, Biochemistry and Microbiology. The curriculum is organized around organ systems, rather than traditional disciplines, and is presented within the framework of patient problems. Specifically, Sequence I is designed to equip students to: a) describe the embryological development of man; b) identify sites of lesions which would cause a symptom and explain how each lesion might cause that symptom; c) demonstrate basic clinical skills; and d) explain the social, philosophical, humanitarian and behavioral ramifications of disease on patients and physicians. This approach is an attempt to integrate the basic sciences, show their interdependence in the functioning of the human body and emphasize the multidisciplinary aspects of medical problems.

The first six weeks of the curriculum illustrate the philosophy of this organization. In Sequence I, Block I, students study the development of a differentiated cell to a full-term fetus. With this embryological theme, students build on their previous knowledge of the human body's structure and function by studying the subtle underlying growth

mechanisms. By hypothesizing abnormal developments, instructors introduce students to a variety of clinical problems. Thus, the inter-relationships between basic sciences such as cellular biology and anatomy to a variety of fields of medicine--obstetrics, psychiatry, pathology, surgery--are made clear.

During Sequences II and III, the student utilizes the knowledge and skills acquired during Sequence I and masters goals relating to disease processes, their etiology and treatment. Specifically, Sequence II prepares students to: a) describe the biochemical, pathophysiological and anatomical effects of a foreign agent (drug, pollutant, virus) on a healthy human body; b) correlate physical examination findings with expected x-ray findings (radiologic findings) and expected results of tissue studies (pathologic findings); c) describe the etiology of a disease; and d) detect abnormal findings through use of physical examination procedures.

Sequence III provides the student with his first complete experience in working with patients. Here the student is taught to: a) diagnose disease, b) prescribe treatment, and c) carry out both diagnostic procedures and emergency and non-emergency treatment. In Sequence III, the student rotates through the departmental clinical clerkships which provide opportunities for integrating prior experiences and for demonstrating the attainment of clinically related goals. Integrated within these clerkships is a continuing series of learning activities related to the behavioral sciences, forensic medicine, practice management, medical ethics, human sexuality, health care systems, death and dying and other health-related fields. These activities are designated as MESH (Medical Education for Society and the Humanities).

Sequence IV is an elective period where students broaden their experience and knowledge in areas which they select.

To insure student coherence of knowledge, as much of the curriculum as possible is organized around medical problems. A problem unit is composed of a set of medical cases, questions about each case to be answered by the students and a series of modules designed to provide students with the competencies necessary to deal successfully with the medical cases. This process increases student motivation by demonstrating the relevance of module objectives to the solution of medical problems and provides a meaningful framework to aid the student in organizing isolated bits of information which might otherwise appear meaningless.

Another feature of the competency-based system in operation at the SIU School of Medicine is application of the principle that learning is an active process which can be accomplished only by the learner. Thus, whenever possible, the student is allowed and encouraged to work independently toward achieving goals, and alternative routes for learning are made available. While students function as independent learners, faculty members function as managers and organizers of learning activities rather than dispensers of knowledge. The faculty and staff also establish a climate of co-learning with the students to encourage the recognition of personal limitations and the need to be a perpetual learner.

Evaluation is a keystone of education, and its paramount role in the curriculum is indicated by the fact that every program unit in the SIU curriculum includes measuring instruments. Evaluation focuses on: a) student progress and b) program modification.

Evaluation of students' progress is determined by their performance of prescribed objectives written into the curriculum. At the end of each module, problem unit and block, student behavior is evaluated. Acceptable levels of Performance are established prior to evaluation in order to guarantee that students are judged on faculty-determined standards (criterion-referenced) rather than in comparison to peer performance (norm-referenced).

If a student's performance is below the established Acceptable Level of Performance, he must recycle. Students are informed as to which objectives the evaluation will include. Within limits, a student may proceed to succeeding modules and accomplish recycles concurrently. To proceed to the next Sequence, a student must successfully complete all units.

Instructional teams determine the need for and mode of evaluation for each problem unit. Some evaluations are in written form, while others are small group, oral evaluations conducted by instructional team members. Such sessions attempt to provide valuable learning experiences as well as evaluative data.

The students themselves have direct input regarding modification of existing programs. They log the materials used and time spent on instruction and evaluate the quality of the materials and instruction, the clarity of the goals and effectiveness of the learning activities. They are asked to comment on significant strengths and weaknesses of the program unit and to make suggestions for improvement. Students' comments and suggestions are reviewed by the curriculum committees, department heads and teaching faculty and are used in making program modification decisions. Their test scores also are used to pinpoint weaknesses in instruction. Moreover, faculty participate in a regular

review of modules within their organ system or clerkship. These evaluation processes insure continuous revision of curricular material.

APPENDIX TWO

NEUROSCIENCE CUMULATIVE GOALS (REHEARSAL ACTIVITIES),

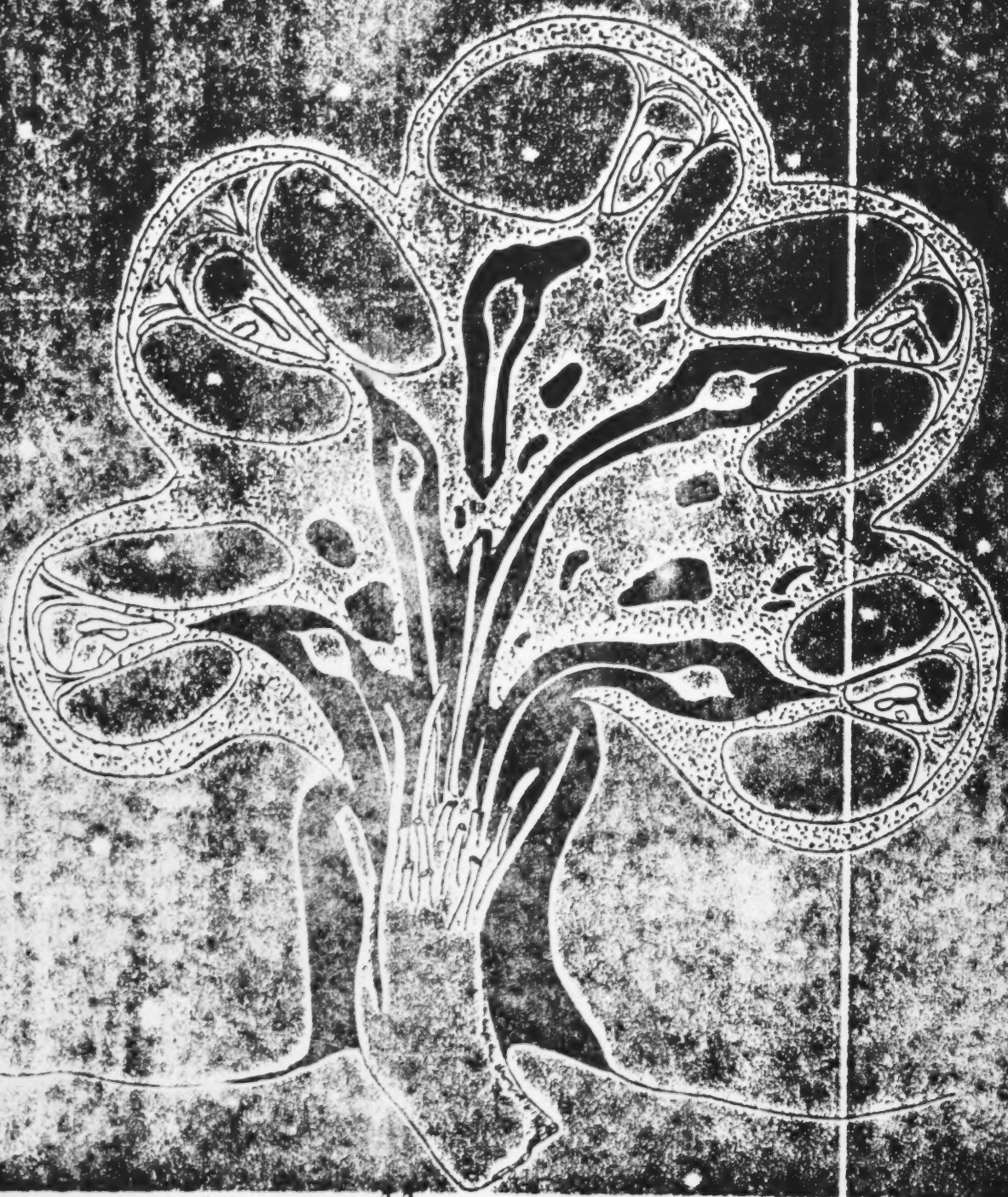
CUMULATIVE MODULES AND CUMULATIVE EXAMINATION

Neuroscience

equence I, 1976-77

Southern Illinois University
School of Medicine

SIU



NEUROSCIENCE BLOCK
1976 - 77

CONTENTS:

PROBLEM UNIT ONE

HEADACHE

MODULES		AUTHOR
I - 1	Anatomy of the Skull Embryology and Overview of Brain Introduction to Neuroradiology	(Dr. Lehr)
I - 2	Cranial Nerves: Functions and Pathways	(Dr. Hunter)
I - 3	Structure of the Meninges, Sensory Innervation of Intracranial Structures, and Mechanisms for Production of Intracranial Pain	(Dr. Paparo)
I - 4	Clinical Skills--Examination of the Cranial Nerves	(Dr. Berkley)

PROBLEM UNIT TWO

DEPRESSION OF CONSCIOUSNESS

MODULES		AUTHOR
II - 1	Membrane Potentials	(Dr. Caspary)
II - 2	Basic Structure and Functions of Neurons and Neuoglia	(Dr. Paparo)
II - 3	Introduction to Neurotransmission	(Dr. Levitt)
II - 4	Energy Metabolism of the CNS	(Dr. Hargrave)
II - 5	Gross Anatomy of the Cerebrum Cytoarchitecture of the Cerebrum Functions of the Cerebrum Radiologic Localization of Cerebral Structures	(Dr. Levitt)
II - 6	Arterial Supply and Venous Drainage of the Brain	(Dr. Estavillo)

MODULES		AUTHOR
II - 7	Neuroanatomical, Neurophysiological, and Neuropharmacological Correlates of States of Consciousness Introduction to CNS Depressants and Anesthetics Introduction to Clinical Electro-encephalography	(Dr. Faingold)
II - 8	Drug Absorption and Routes of Drug Administration	(Dr. Browning)
II - 9	Classification of Seizures Introduction to Anticonvulsants	(Dr. Browning)
II - 10	Neuropathology of Cerebral Edema	(Dr. Salmon)
II - 11	Neuropathology of CNS Inflammation	(Dr. Salmon)
II - 12	Clinical Skills--Examination of Higher Intellectual Functions	(Dr. Berkley)

PROBLEM UNIT THREE

DYSEQUILIBRIUM

MODULES		AUTHOR
CLINICAL CASE		
III - 1	Anatomy and Physiology of the Peripheral Auditory and Vestibular System	(Dr. Caspary)
III - 2	Gross Anatomy of the Brain Stem Microscopic Anatomy of the Brain Stem Radiologic Localization of Brain Stem Structures	(Dr. Lehr)
III - 3	Gross Anatomy of the Cerebellum Microscopic Anatomy of the Cerebellum Cerebellar Functions Radiologic Localization of the Cerebellum	(Dr. Lehr)
III - 4	Arterial Supply of the Infraentorial Brain	(Dr. Lehr)

MODULES		AUTHOR
III - 5	Histologic Peculiarities of Cerebral Arteries, Veins and Venous Sinuses Regulation of Cerebral Blood Flow	(Dr. Easton)
III - 6	Anatomy of the Ventricular System, Cisternae and CSF	(Dr. Estavillo)
III - 7	Clinical Skills--Examination of Cerebellar and Vestibular Function	(Dr. Berkley)

PROBLEM UNIT FOUR

BOWEL AND/OR BLADDER DYSFUNCTION

MODULES		AUTHOR
CLINICAL CASE		
IV - 1	Gross Anatomy of the Vertebral Canal	(Dr. Estavillo)
IV - 2	Topography of the Spinal Cord	(Sharon Smith)
IV - 3	Autonomic Nervous System: Anatomy and Physiology of the Parasympathetic and Sympathetic Divisions	(Dr. Estavillo)
IV - 4	Physiology and Pharmacology of the Autonomic Nervous System	(Dr. Browning)
IV - 5	The Neurophysiology of Bladder and Bowel Control	(Dr. Palagiri)
IV - 6	Clinical Skills--Examination of Autonomic Function	(Dr. Berkley)

PROBLEM UNIT FIVE

CHANGES IN SENSATION

MODULES		AUTHOR
CLINICAL CASE		
V - 1	Neuroembryology Embryology of Face, Nose and Palate	(Dr. P. BeMiller)

MODULES		AUTHOR
V - 2	Structure and Function of Myelin Degeneration and Regeneration of Nerves	(Dr. P. BeMiller)
V - 3	Histology of Peripheral Nerves	(Dr. Hunter)
V - 4	Dermatome Distribution Major Nerves of the Extremities Segmental Levels of Major Superficial and Deep Tendon Reflexes	(Dr. Estavillo)
V - 5	Location of Major Afferent Tracts in the Spinal Cord General Physiologic-Anatomic Correlates of Sensation	(Dr. Hunter)
V - 6	Pharmacology of Local Anesthetics and Analgesics	(Dr. Browning)
V - 7	Biochemistry of Vision	(Dr. Hargrave)
V - 8	Anatomy of the Eyeball and Visual Pathways Physiology of Vision	(Dr. Caspary)
V - 9	Clinical Skills--Examination of Simple and Cortical Sensation	(Dr. Berkley)

PROBLEM UNIT SIX

PARESIS OR PARALYSIS/INVOLUNTARY MOVEMENTS

MODULES		AUTHOR
CLINICAL CASE		
VI - 1	Microscopic Structure of Skeletal Muscle Physiology of Skeletal Muscle	(Dr. Paparo)
VI - 2	Anatomy, Physiology and Pharmacology of the Neuromuscular Junction	(Dr. Hunter)
VI - 3	Anatomy and Physiology of the Gamma Loop Intra-spinal Reflexes: Stretch, Flexion and Crossed Extension	(Dr. Estavillo)

MODULES		AUTHOR
VI - 4	Anatomy, Physiology and Pharmacology of the Caudate and Lenticular Nuclei	(Dr. Levitt)
VI - 5	Decorticate, Decerebrate and High Spinal Preparations Location and Function of Major Descending from Brain into Spinal Cord	(Dr. Hunter)
VI - 6	Clinical Skills--Examination of the Motor System including the Reflexes	(Dr. Berkley)

PROBLEM UNIT SEVEN

INTELLECTUAL DETERIORATION OR RETARDATION

MODULES		AUTHOR
VII - 2	Mechanisms of Learning and Memory	(Dr. Bliss)
VII - 3	Learning and Memory	(Dr. Bliss)
VII - 4	Mental Retardation	(Dr. Bliss)

PROBLEM UNIT EIGHT

AFFECTIVE CHANGE OR MALDEVELOPMENT

MODULES		AUTHOR
CLINICAL CASE		
VIII - 1	Stress and Psychological Defense Mechanisms	(Dr. Travis)
VIII - 2	Psychopathology: Terms Commonly Used in Describing Disorders	(Dr. Travis)
VIII - 3	Introduction to Drug Abuse	(Dr. Levitt)
VIII - 4	Structure and Functions of the Limbic System	(Dr. Levitt)
VIII - 5	Neuropharmacology of Psychotropic Agents	(Dr. Browning)
VIII - 6	The Mind Body Relationship	(Ms. Falvo)
VIII - 7	Clinical Skills--Mental Status Examination	(Dr. Travis)

SEQUENCE I

NEUROSCIENCE BLOCK

INTRODUCTION:

The material which follows was compiled to provide a guide for an easily modified, integrated, systems oriented curriculum. The curriculum is designed to establish clearly stated educational goals which integrate basic and clinical neurosciences over a three-year period.

The curriculum of the Neuroscience Block, for first year (Sequence I) students is comprised of eight problem units, each categorized by one of the eight generalized symptom forms characterizing neuroscience diseases confronting the primary physician. These major symptom forms have been termed "input indicators" signifying input into a particular diagnostic category. Subindicators have also been listed which represent examples of specific symptoms associated with an input indicator and thus to one of the eight problem units.

Each Problem Unit begins with a characteristic clinical problem. In solving the problem, the student works through the basic science material associated with each of the diagnostic categories, and at appropriate times is exposed to case presentations and training in basic clinical skills.

A major objective in development of this curriculum arose from our concern that primary care physicians generally possess minimal proficiency in diagnosis and treatment of neural disorders. This includes not only the family practitioner, but also the pediatrician, obstetrician-gynecologist, general surgeon, and general internist.

In order to better equip our students to utilize recent advances in the categorization and treatment of neural disease, we have included information on the major form of presentation of particular disease entities, the prevalence of disease entities (i.e. type of case which a primary physician will see more than "once every five years"), the fact that there is an effective treatment for a disease entity, and the possibility of simplifying the approach to a particular disease. Thus, the medical student will be given tools with which to handle clinical neuroscience problems. Working within the indicator-diagnostic modules he will also be, at least by association, introduced to the rarer forms of disease and learn when a particular case should be referred to a specialist. The program is directed toward establishing the competency of the primary physician in such a systematized way as to facilitate further expansion of a well established base of scientific knowledge.

The integrated curriculum with its problem solving orientation appears (by internal standards as well as more traditional standards such as National Boards) to be successfully coping with current problems in medical education by applying techniques generated from recent advances in understanding the learning process, applying systems theory, introducing the student to computer patient management, and integrating the massive explosion of medical knowledge.

INPUT INDICATORS:

1. headache

   subindicators: tight band, sharp pain, throbbing pain, etc.

   diagnostic categories:

   brain tumor
   hydrocephalus (communicating, obstructive)
   CNS infection (encephalitis, meningitis)
   cervical spine disease (bone, root, soft tissue)
   cerebral vascular disease (ischemic infarction, subarachnoid hemorrhage, transient ischemia)
   temporal arteritis
   cerebral trauma (concussion, contusion-laceration, cerebral edema, subdural and epidural hematoma, skull fracture)
   trigeminal neuralgia
   vascular headache (migraine syndrome, cluster headache)
   muscle contraction headache
   sinusitis

2. depression of consciousness

   subindicators: sleepy, confused, delirious, etc.

   diagnostic categories:

   brain tumor
   metabolic encephalopathy (diabetes, uremia, hepatic, vitamin deficiencies)
   chemical intoxication (alcohol, medications, heavy metals)
   epilepsy (grand mal, petit mal, psychomotor)
   cerebral vascular disease (infarction, transient ischemia, intra-cerebral hemorrhage, subarachnoid hemorrhage)
   cerebral trauma (concussion, cerebral edema, contusion-laceration, epidural subdural)
   CNS infections (meningitis, encephalitis)
   syncope (vaso-depressor, cardiac, orthostatic hypotension)

3. dysequilibrium

   subindicators: dizzy, light-headed, unbalanced, spinning, etc.

   diagnostic categories:

   multiple sclerosis
   orthostatic hypotension
   cervical vertigo
   paroxysmal positional vertigo
   vestibular neuronitis
   Meniere's disease
   hyperventilation syndrome
   brain tumor (especially posterior fossa)
   chemical intoxication (especially alcohol, medications)

3. dysequilibrium (continued)

somatic complaint of emotional disturbance
transient ischemic attack (especially posterior circulation)
cerebral infarction (posterior circulation)
familial spinal and/or cerebellar degenerations

7. intellectual deterioration or retardation

subindicators: confused, backwards, hallucinations, speech difficulty, irrational, etc.

diagnostic categories:

brain tumor
hydrocephalus
combined systems disease
chemical intoxication (especially alcohol, medications, heavy metals)
neurologic dysfunction, collagen-vascular disease
neurosyphilis
minimal brain dysfunction
psychomotor retardation
chromosomal disorders
neurocutaneous syndrome
cerebral vascular disease (especially transient ischemia, infarction)
residual of cerebral trauma (especially chronic subdural)
metabolic encephalopathy (especially thyroid disease, diabetes, steroid)
senile and presenile dementia
psychosis
psychoneurosis
multiple sclerosis
leukodystrophy
lipidosis

8. affective change or maldevelopment (i.e. changes in feeling, emotion, desire in terms of determining changes or development in thought and conduct)

subindicators: depressed, tense, euphoric, behavior problem, delinquent, withdrawn, etc.

diagnostic categories:

central nervous system dysfunction, collagen-vascular disease
psychosis
psychoneurosis
personality disorder
transient situational personality disorder
senile and presenile dementia
diffuse cerebral vascular disease
chemical intoxication (including LSD, alcohol, opiates, bromides)
metabolic encephalopathy (thyroid disease, steroid abnormalities)
brain tumor
residual of cerebral trauma (especially chronic subdural)
hydrocephalus

4 . bowel and/or bladder dysfunction

subindicators: incontinence, hesitancy, urgency, frequency, etc.

diagnostic categories:

spinal cord tumor
spinal cord injury
lumbar disc
spinal dysraphism
neurologic dysfunction, diabetes
minimal brain dysfunction
somatic manifestation of emotional disorder (especially transient situational personality disorder of childhood, psychneurosis, psychosis)
cerebral vascular disease (especially infarction anterior circulation)
senile and presenile dementia

5. changes in sensation

subindicators: paresthesias, numbness, loss of vision, decreased hearing, etc.

diagnostic categories:

brain tumor
spinal cord tumor
spinal cord trauma
herniated disc (lumbar or cervical)
spinal dysraphism
spinal cord infarction
brachial plexus injury
thoracic outlet syndrome
compressive or traumatic neuropathy (especially carpal tunnel syndrome, ulnar nerve palsy, radial nerve palsy, peroneal nerve palsy)
polyneuropathy (especially nutritional, diabetic, heavy metal, nonmetastatic effects of carcinoma, medications)
neurosyphilis (especially tabesdorsalis)
heredity peripheral neuropathy
cerebral vascular disease (especially infarction, transient ischemia)
hyperventilation syndrome
somatic manifestation of emotional disorder (especially psychoneurosis, transient situational personality disturbance)
multiple sclerosis
radiation injury of spinal cord

6. A. paresis or paralysis

subindicators: weak, have lost the use of, "numb", etc.

diagnostic categories:

brain tumor
spinal cord tumor
spinal cord trauma
herniated disc (lumbar or cervical)
spinal dysraphism
syringomyelia

spinal cord infarction
brachial plexus injury
facial nerve palsy
compressive or traumatic neuropathy (including carpal tunnel syndrome, ulnar nerve palsy, radial palsy, peroneal palsy)
polyneuropathy (especially nutritional, alcohol, diabetic, heavy metals, hereditary)
nonmetastatic effects of carcinoma
myopathy (myotonic, myasthenic, dystrophy, myositis, periodic paralysis)
Guillain-Barre syndrome
amyotrophic lateral sclerosis
cerebral vascular disease (especially cerebral infarction, transient ischemia, AV malformation)
somatic manifestation of emotional disorder (especially psychoneurosis, personality disorder)
multiple sclerosis
leukodystrophy
radiation injury of spinal cord

B. involuntary movements

subindicators: shaking, jerking, drawing, head shaking, twisting, constant and paroxysmal symptom, etc.

diagnostic categories:

epilepsy (especially petit mal, focal motor)
Parkinsonian syndrome
essential tremor
habit spasm or tic
chorea syndromes
dystonia/torticollis
tetany
amyotrophic lateral sclerosis
hemiballism
choreoathetosis (especially secondary to perinatal brain injury, Wilson's disease)
hyperventilation syndrome
somatic manifestation of emotional disorder (especially psychoneurosis)

NEUROSCIENCE BLOCK
1976-77

CONTENTS

PROBLEM UNIT ONE

MODULES	AUTHOR	PAGE NO.
I-1 Anatomy of the Skull Embryology and Overview of Brain Introduction to Neuroradiology	(Dr. Lehr)	
I-2 Cranial Nerves: Functions and Pathways	(Dr. Anthoney)	
I-3 Structure of the Meninges, Sensory Innervation of Intracranial Structures and Mechanisms for Production of Intracranial Pain	(Dr. Paparo)	
I-4 Clinical Skills--Examination of the Cranial Nerves	(Dr. Berkley)	

SEQUENCE I: NEUROSCIENCE BLOCK

PROBLEM UNIT I - INDICATOR: HEADACHE

INTRODUCTION: Before proceeding you are directed to read the following quite carefully as it will outline the approach to the neuroscience problem unit and thus to the curriculum in general. The problem unit consist of a clinical case and several modules, the modules consist of basic science material relevant to the clinical case. Very often the module material will make direct reference to this clinical case. The problem unit construction was purposely done in order to produce strong associations between the clinical and basic science material, and thus enhance your retention of the basic science material. It is strongly suggested that on the first day of each new problem unit, the entire problem unit be scanned to make you aware of the materials involved. Special emphasis should be placed first on the clinical case, with a review of the questions raised at the end of the case. These questions, as well as the diagnostic problems listed, are meant to introduce you to the basic science modules which follow. It is also meant for you to actively relate the basic science material to the questions and diagnostic problems in the clinical case to increase retention of all information. After gaining some introductory understanding of the clinical case and its questions, you are to proceed with the modules, including the clinical skills material. You will have one day at least to review the clinical case and in writing, answer briefly either in short paragraph or outline form, the questions accompanying the clinical case. We will also ask you to make a diagnosis in terms of the problem list. This material should be handed in to your instructor by the end of the session during which the clinical case will be discussed in small groups. A student will not be considered to have completed a problem unit if this written material has not been completed and handed in. Although extenuating circumstances may occur on one occasion, the clinical case material is considered of major importance and we will not expect extenuating circumstances to re-occur. The instructors in you clinical session will be expected to return your papers promptly with comments both as to your written and oral discussion during that session. The clinical case questions are basic science oriented and may be answered from the knowledge you have accumulated during your study of the modules and the particular problem unit.

CLINICAL CASE

This 35-year old, white female presented to her family physician for evaluation of persistent headache. Since her teenage years, the patient had had episodes of headache which involved throbbing pain over the right side of the head mainly in the frontal-temporal region. These were often preceded by a visual sensation of a "fuzzy ball" in the center of her visual field. On occasion both the headache and visual sensation would occur simultaneously but usually the visual sensation preceded the headache. The throbbing pain would increase and finally after several hours the patient would become nauseated and at times would vomit. This would relieve the headache which usually lasted for several hours. But, of recent weeks she tended to have more diffuse, aching headaches lasting for four

or five days after the initial throbbing episode of pain. The patient had been intermittently free of headache for several years, but when beginning birth control pills, the headaches reappeared at a rate of approximately two or three per year. Over the past year, the headaches had increased in frequency so that now she had one to two such episodes per week. These particular episodes of headache usually occurred on the weekend, or a day or two after she had completed an arduous task. They occurred at any time of the day. Intermittently she had a slightly different headache which would last for prolonged periods, and consisted of an aching sensation or tightness in the occipital and frontal area. These, however, were relieved somewhat by aspirin. Before coming to her present physician, the patient had been treated for intermittent episodes of anxiety on various tranquilizers and was felt to be a rather high-strung individual. Other neurologic symptoms including diplopia, difficulty with swallowing, specific weakness, changes in tactile sensation, or difficulty with gait, were not present. Review of other organ systems was also negative. Of interest in the family history was the presence of vascular disease and diabetes. Beside the problems listed above, the patient had had no serious illnesses or operations or injuries in the past. The patient has two children, is a housewife, and comes from a middle income family.

The general examination revealed normal blood pressure, pulse, respiration, and temperature. Examination of the chest, heart, and abdomen were without abnormality. Neurologic examination revealed a right handed young lady with very normal gait and station, who complained of non-specific "dizziness" when she closed her eyes, but no objective changes were noted. There were no bruits (i.e. sounds of turbulent vascular flow over arteries) over the skull or neck. There was no rigidity present or abnormalities of the spine on palpation or percussion. Careful pappation of the para-spinal cervical musculature revealed some spasm and tenderness on the right. Examination of the cranial nerves showed no specific abnormality. Strength, tone, and coordination were normal. Both simple and cortical sensation were also intact. Reflexes were hyperactive throughout, but no pathologic reflexes were noted. Some question was raised of a slight left reflex preponderence as compared to the right side (in the upper extremities). Autonomic function including sweating and blood pressure regulation appeared normal.

With the above collected data base, i.e. the history and physical examination, the following problem list was generated:

1. Early 1950's--throbbing, right frontal-temporal headache, probably _____ headache. Rule out underlying A-V malformation, (embryonic rest of arteries joined directly to veins due to lack of capillary proliferation) at times associated with such headaches when they are unilateral, (i.e. one sided).

2. 1971--frontal-occipital aching, band-like headache, probably _____ type.

3. 1950's--mild personality disorder with persistent anxiety. Question relationship to the present severity of problems one and two.

With the above problems (presumptively) delineated, the following plan was instituted:

Problem 1: Because of the possibility of underlying intracranial A-V malformation, skull x-rays and an EEG were ordered. For treatment, the patient was given a prescription for an ergotamine and caffeine tablet, two of which were to be taken at the first sign of this particular type of headache. Birth control pills were discontinued on trial basis to assess the effect of the hormone preparation on the frequency of these headaches.

Problem 2: Because the etiology of this headache type appeared rather clear cut, and the response to aspirin was quite effective, aspirin was continued as previously taken by patient.

Problem 3: The patient's present life situation was discussed to some degree in terms of her relationship with her husband and children to ascertain whether there was any increased stress situation which may have exacerbated either of the two headache categories. She was admittedly a rather tense and anxious lady, who responded rather extremely to mild stress, and careful evaluation of the situation for underlying point of emotional conflict was made. Because of the severe nature of the headaches and presumed interaction with the patient's personality difficulties, valium 5mg., q4-6 hours as needed, was prescribed for severe anxiety which tended to correlate with the onset of the various types of headache. Again an effort was made to avoid chronic tranquilizer administration since dependence on this medication would not alleviate the patient's personality problem. Thus, a tranquilizer was used as a temporary aid in treatment.

MEDICAL QUESTIONS: (Written answers not necessary for questions marked *)

1. In muscle contraction headache affecting the frontal and occipital areas, what muscle groups would be affected? What are the basic anatomical movements which these muscles control?

2. In vascular type headache, the pathophysiology appears to be transient constriction of both intracranial and extracranial arteries followed by dilatation with stimulation of the pain fibers which surround the arteries. In this particular case, what arteries would appear to have been causing the aura?; the actual throbbing pain? Can you follow these arteries down to their common origin? What would be the pain pathway to the brainstem in this case? What is the proposed relationship between oral contraceptives, headache and thromboembolic phenomena (stroke)?

3. Slides of the skull x-rays are included for your examination. Are there any abnormalities noted, especially in terms of intracranial calcification which is often associated with an A-V malformation? In what portion of the skull in this particular case would such an abnormality be present? This, of course, must be answered in terms of the distribution of pain. Is the pineal gland calcified? If so, is it shifted from its midline position (parietal to parietal distance)? What would be the significance of such a shift?

4. In what particular part of the brain, that is lobe of the brain, would such a malformation be present in this particular case?

5. A-V malformations can bleed and since they are located in the brain substance, tend to bleed into what particular meningeal space?

6. If vascular headache is severe and unremitting when associated with A-V malformation, surgical extirpation is often attempted. Through what bones of the skull in this particular patient could the craniotomy be made? What meningeal layers would have to be incised to reach the brain substance? What very important vessel has its course in this area of the skull which the neurosurgeon must be sure to ligate or avoid?

*7. If this young woman's psychiatric problem turns out to be of major import, what sources of referral would be available to the family practitioner?

LEARNING RESOURCES:

1. Cecil-Loeb's, or Harrison's, Textbook of Medicine, "Section on Headache".

   Goth, Medical Pharmacology, Re: Ergotamine, valium, oral contraceptives, etc. pp. 209-210, 230-232, 521-522 (Reprint available)

   Slager, Basic Neuropathology, "Vascular Malformations". pp. 61-64 (Reprint available)

   Mecham, Normal Radiographic Anatomy, "Section on Skull X-ray".

2. Basic Science modules of Problem Unit I and clinical skills of Problem Unit I, especially in terms of the anatomy illustrated by skull x-rays.

3. Clinical case skull x-rays: as 35 mm slides (I-5, 6, 7, curriculum).

Author: Dr. Lehr
1976 Revision

DOMAIN: Anatomy of the skull
Embryology and overview of brain
Introduction to neuroradiology

PREREQUISITES: Locomotor Module 0.05 - Anatomic Terminology

GOALS:

1. * Define the terms listed in Table 1.

2. * When presented with an intact human skull, with hinged calvarium or drawing thereof, (a) point out and name each bone of the cranium (8) and face (14); (b) point out and identify each surface marking (of bones) listed in Table 2A and name the bone on which it is found; (c) point out the extent of and name the bones which comprise the anterior, middle, hypophyseal (sella turcica), and posterior cranial fossae. In addition, point out those foramina which open into each fossa as listed in Table 2B; (d) point out the air sinuses listed in Table 2C; (e) point out and name the major sutures of the skull as listed in Table 2D; (f) point out the position of the bregma, pterion, asterion, and lambda and name the fetal precursors of these points.

3. * Describe very briefly, orally or in writing, or be able to point out on a brain or model of a brain the major embryological and/or adult features of the brain as listed in Table 3.

4. * By use of models and verbal or written description, demonstrate the basic orientation of the cerebrum, cerebellum, pituitary gland and brain stem (thalamus, midbrain, pons, and medulla oblongata) in the cranial cavity.

5. Be able to describe in writing, on a diagram, or orally, with or without a skull, the following anatomic points, lines, and planes.

* See Criteria.

Inion
Infraorbital point
Nasion
Anthropological (Reid's) basal line
Anthropological plane (horizontal plane of Frankfurt)
Auricular line
Midsagittal plane
Orbitomeatal plane

6. When presented with an X-ray of the skull, be able to identify the view: P-A, base, lateral, or Townes, and be able to communicate the position of the film casette and X-ray beams relative to the head or skull, either in writing or by oral demonstration with a head or skull.

7. Presented with a lateral X-ray view of the skull, be able to decide whether or not the central X-ray beam was actually perpendicular to the midsagittal plane and to explain the reasons for your opinion.

8. When presented with a P-A or lateral X-ray view of the skull, be able to describe, orally or in writing, a systematic procedure for analyzing the information in the X-ray.

9. When presented with a P-A or lateral X-ray view of the skull, be able to draw the basic orientation of the cerebrum, cerebellum and brain stem in the cranial cavity.

10. Identify on a P-A, base, or lateral, X-ray view those structures chosen from Table 2 by the evaluator. (excluding those items marked with an *astrick).

11. Describe very briefly, orally or in writing, the process of arteriography and point out on an arteriogram the aortic arch, subclanian, corotid, vertebral and brachiocephalic trunks.

12. Give a verbal or written description of the process of diagnosing a neurological illness.
    Should include:

    a) Anatomical localization
        1. Central vs. Peripheral
        2. Upper vs. Lower Motor Neuron
        3. Decussation of pathway in longitudinal
        4. Single site vs. multiple site section

    b) Pathology

EVALUATION CRITERIA:

1. Self evaluation*

2. Self evaluation*

3. Self evaluation*

4. Self evaluation*

5. As described in Taveras and Wood - pp. 1.5-1.6.

6. The student must describe the view accurately and describe the position of film and X-ray beams relative to the skull accurately, as found on pp. 1.6-1.7 of Taveras and Wood.

7. The decision should be accurate and properly defended on the basis of comparison of symmetrical bony structures.

8. The response must include the main categories listed on pp. 1.8-1.31 of Taveras and Wood, or Meschan p. 240.

9. The drawing must show proper inter-relationships among the structures drawn as well as between them and the bony landmarks of the skull.

   Lateral view should include

   1.) Cerebrum - frontal, temporal and occipital poles
   2.) Cerebellum
   3.) Pituitary gland
   4.) Brain stem - a. midbrain
   b. pons
   c. medulla

   P-A view should include

   1.) Cerebrum - frontal and temporal poles
   2.) Pituitary gland

* N.B.: Unless specified differently, self-evaluation goals are included as suggested learning activities which a student might find useful toward attaining competence in the formally evaluated goals. The student is advised strongly, however, to organize his study around achieving the formally evaluated goals, carrying out self-evaluation activities only when and in so far as they are necessary to that end. Otherwise, they should be pursued only after preparation for formally evaluated goals is completed, if the student has free time, and if he has the interest.

10. The student must give accurate responses to at least 80% of all questions asked.

11. The student must give accurate responses to 100% of all questions asked.

12. To be continually evaluated in later modules as data base increases. Current expectation is an understanding of the overview (process and main topics in goal) of the process of neurological diagnosis.

ESSENTIAL LEARNING RESOURCES:

1. A medical dictionary.

2. a. Snell - pp. 686-687
   b. Snell - pp. 686-694
   c. Snell - pp. 695-701
   d. Snell - pp. 757-759
   e. See 2b above and Willis and Grossman - p. 116
   f. Willis and Grossman - p. 116

3. Willis and Grossman - pp. 124-125. You will be held responsible for only those terms in Table 3.

4. Willis and Grossman - p. 117, "Relationships of the brain to fossae..." First two paragraphs only at this time.

5. Taveras and Wood - pp. 1.5-1.6

6. Meschan - Normal Radiographic Anatomy - p. 257 (*Reprint Available*)

   A-P or P-A - pp. 260-261
   Base (axial view of skull) - pp. 266-267 (*Reprint Available*)
   Lateral - pp. 264-265
   Townes - pp. 262-263

   Taveras and Wood - pp. 1.6-1.7

8. Taveras and Wood - pp. 1.8-1.31 (scan for orientation and categories - details not necessary) (*Reprint Available*)

9. Willis and Grossman - p. 117; p 151. Fig. 5-32.

10. Snell - pp. 767-776
    Meschan - see references for goal 6.

11. See attachment "Introduction to Aortic Arch Arteriography."

12. Willis and Grossman - pp. 345-349.

ADDITIONAL LEARNING RESOURCES:

Willis and Grossman - pp. 116, 124-125
Snell - pp. 613-616
Langman - pp. 290-293 (Reprint in Library)

In gross anatomy lab
cadavers for dissection
prosected cadavers
dry (intact) skulls with hinged calvarium
disarticulated skulls
articulated skeletons
Froshse charts of anatomy
skull X-rays, set of 4 (curriculum slides I-1, 2, 3, 4)

Attached:
Table 1: Terms relevant to Module I-1.
Table 2: Structures of head and neck.
Table 3: Embryological and adult brain structures
Introduction to aortic arch arteriography

Personnel:

Dr. Lehr (Module Leader)
Dr. Hunter
Dr. Moore
Dr. Parke
Ms. Sharon Smith
Teaching Assistants

Scheduled Activities:

Orientation Lecture - French [2 hours].

Author: Dr. Hunter
1976 Revision

DOMAIN: Cranial Nerves: Functions and Pathways

PREREQUISITES: Neuroscience Module I-1
Locomotor Modules 0.20-0.60

GOALS:

1. From memory, define briefly in writing the terms in Table 1.
2. In writing, from memory:
   a) Diagram the taste receptors and olfactory receptors,
   b) List the classes of stimuli that activate taste receptors and describe which parts of the tongue are sensitive to each,
   c)* Diagram schematically the pathways centrally associated with each cranial nerve, tracing the path of efferent impulses from cerebral cortex to muscle, tracing the path of afferent impulses from receptor cell to cerebral cortex (when applicable), and naming each tract and each ganglion or nucleus in which a cell body (for monopolar first-order sensory neurons) or a synapse occurs,
   d)* Diagram schematically and label the parts of the pathways involved in the direct and consensual (indirect) pupillary light reflexes, the pupillary response to accommodation (focusing from a far to a near object), the corneal reflex, the jaw jerk reflex, and the gag reflex.

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*N.B. Knowledge of CNS pathways referred to in these goals is in no way necessary to prepare for the goals formally evaluated in this module. The student may, however, find that he can remember the peripheral pathways more easily if he sees them as part of complete functional circuits. Also, a student who has sufficient time may wish to work on these goals to acquaint himself ahead of time with the names of some of the 50-100 new structures he will be studying in Neuroscience Module III-2.

3.* When presented with a list of direct injuries to CNS pathways functionally related to cranial nerves (including names of damaged structures), list the probable results of each in terms of sensory and/or motor abnormalities of the head and neck region.

4. From memory, on the base of a "fresh" brain and/or in the cranial vault of a human cadaver from which the brain has been removed, point out and name the cranial nerves or their "stubs" and describe their relations (as appropriate) to the intra-cranial structures studied in Module I-1. Also, locate and name each exposed ganglion, whether grossly discernible or not.

5. From memory, on a dry skull with hinged calvarium, point out and name the orifice(s) through which each cranial nerve passes.

6. From memory, on prosected human cadavers, trace the intraosseous and extracranial course of each cranial nerve, naming the muscles, vessels, and surface markings of bones studied in Module I-1 (and in Locomotor) that lie adjacent to each.

7. From memory, on standard X-ray views of the head and neck, name and locate the intra-cranial portion of each cranial nerve.

8. From memory, on an intact human (living or dead), name and trace the extra-cranial course of each cranial nerve.

9. When presented with a list of sensory and/or motor symptoms or signs involving the head (and neck) region, name the cranial nerve(s) corresponding to each abnormal finding.

10. When presented with a list of direct "injuries" to cranial nerves (including names of damaged structures), list the probable results of each in terms of sensory and/or motor abnormalities of the head and neck region.

11. When presented with a list of "injuries" to non-CNS areas in the head and/or neck region (including names of non-pathway structures damaged), name the cranial nerves nearby that might also be included in the damaged area.

EVALUATION CRITERIA:

1.-8. Self evaluation

9. 100% Accuracy

10. At least 80% accuracy

11. Cumulative goal (see N.B. below - important!)*

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*N.B. Cumulative goals evaluate competencies which require knowledge or skills acquired in earlier modules. Goal 11 in this module involves integration of information in Neuroscience Modules I-1 and I-2 and Locomotor Modules 1.10-1.15. Cumulative goals typically require much preparation time

As a ball-park figure, probably at least 50% of total prepara-

LEARNING RESOURCES:

Essential:

1. Medical dictionary

2. a) Curtis, Jacobson, and Marcus - pp. 425-428
   b) Curtis, Jacobson, and Marcus - p. 425
   c) Willis and Grossman - pp. 237-239, 243-247, 250-252, 255-256, 262, 265-267, 279, 354 (diagram of face), 364-372
   d) Willis and Grossman - pp. 270, 373-374

3. Same as for 2 c) and 2 d)

4. Snell - pp. 698-700, 709, 712-715

5. Snell - pp. 692-693, 712-715
   Willis and Grossman - pp. 117-119

6. Snell - pp. 777-788

9.-10. Willis and Grossman - pp. 364-374
   Module I-4

11. Locomotor Modules 1.10-1.15

Additional:

Crosby, Humphrey, and Lauer - pp. 171-179, 262-264 (in library)
Matzke and Foltz - pp. 32-38, 64-68 (in library)
Curtis, Jacobson, and Marcus - pp. 239-259

National Medical Audiovisual Center: Neuroanatomy Demonstration.
Topography: Cranial Nerves (V-2332). Trigeminal Pathways (V-2343).

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tion time for Neuroscience modules should involve the cumulative goals; time estimates for student preparation that appear in modules containing cumulative goals take into account preparation for these goals. Cumulative goals will be evaluated in the Cumulative modules, and also as part of the module in which they first appear. The student must pass the cumulative goals in a non-cumulative module to pass the module; however, a passing performance will be considered to be roughly one half that required to pass similiar goals for the cumulative module. Goal 11 of Module I-2 will be evaluated formally, along with Goals 9-10, though Module I-2 will be completed satisfactorily with minimal competency for Goal 11 at this time. If the student does not pass Goal 11 now, particularly if he's not even close, it should be considered as a sign that serious problems may develop later on in the block.

Attached to Problem Unit I:

Table 1: Terms relevant to Module I-2
Table 2: Cranial nerve mnemonic
Module I-4: Examination of the Cranial Nerves

Personnel:

Dr. Hunter (Module leader)
Dr. Estavillo
Dr. Lehr

Scheduled Activities:

See schedule.

Author: Dr. Estavillo
1976 Revision

DOMAIN: Arterial Supply and Venous Drainage of the Brain (with emphasis on the supra-tentorium)

PREREQUISITES: Neuroscience Problem Unit I and Modules II-2 and II-5

GOALS:

1. When presented with a fresh brain and cranial vault of a human cadaver, point out and name the arteries (supra-tentorial only), veins, and venous sinuses listed in Table 1.

2. Diagram the circle of Willis and label the component arteries. Describe briefly the relationships between the arteries and the optic nerve, optic chiasm, optic tract, hypophysis, and anterior perforated substance.

3. Draw (and label) within outlines of the cranium corresponding to P-A, lateral, and Townes views, the arteries (supratentorial only), veins, and venous sinuses as they appear (proper locations) on "normal" arteriographic studies. List the parts of the cerebral cortex, corona radiata, or internal capsule supplied by each supratentorial artery (if applicable), in terms of structures listed in Table 1 of Module II-5; also list the artery (arteries) supplying each functional area of cerebral cortex listed in Table 3 of Module II-5. For the venous sinuses and veins, indicate briefly the sequence of flow, including at least three emissary veins.

4. Describe one arterial variant or anomaly in the carotid system and another involving the circle of Willis, giving the relative frequency of occurrence and potential clinical importance in each case.

5. Describe one site of anastomosis between branches of the external and internal carotid arteries and another between branches of the external carotid and vertebral arteries. Discuss briefly their clinical significance.

6. When presented with a diagram of the lateral surface of a cerebral hemisphere, indicate the "watershed" areas, describe briefly their clinical significance.

7. When presented with an X-ray taken during the venous phase of a carotid and/or vertebral arteriogram, name the labelled veins and venous sinuses (from list in Table 1), and list in sequence the remaining intra-cranial veins and venous sinuses to be entered by blood in each labelled venous structure.

8. When presented with a set of skull X-rays (standard views), point out and name the intra-cranial point of origin of one commonly found emissary vein, the foramen transmitting each one (on the skull), and name an extracranial venous structure in which emissary veins may assume clinical significance.

9. Describe 1) how to find or construct the following ponts, lines, distances, angles, and triangles on an arteriogram, 2) what normal relationships to CNS anatomy make each of them useful for orientation, and 3) an example of a potential arteriographic abnormality involving each of them and what the abnormality would (or might) indicate.

    a) The Sylvian point (lateral and frontal views)
    b) The Sylvian triangle (lateral view)
    c) The venous angle (frontal view - to be evaluated in Module IV-1)

10. When presented with an X-ray taken during the arterial phase of a carotid and/or vertebral arteriogram, identify the view, describe any abnormality (in position, calibre, etc.) in supratentorial arteries, and describe briefly each designated point on a supratentorial artery (e.g., proximal portion of middle cerebral artery or point where internal carotid divides into anterior and middle cerebral arteries).

11. When presented with an X-ray taken during the arterial phase of a carotid and/or vertebral arteriogram, identify the view, describe briefly each designated point on a supratentorial artery (e.g., proximal portion of middle cerebral artery or point where internal carotid divides into anterior and middle cerebral arteries), list the abnormal neurologic findings one might expect to find if blockage (e.g., due to thrombosis or embolism) or hemorrhage occurred at that point, and explain the anatomical basis for the abnormal findings.

EVALUATION CRITERIA:

1.-3. Self evaluation.

4. As described on pp. 1.534-1.537 of Taveras and Wood

5. As described in Willis and Grossman - p. 153 or Curtis, Jacobson, and Marcus - pp. 353, 538.

6. For anatomical basis and clinical significance, as described on pp. 158-159 of Willis and Grossman or p. 538 of Curtis, Jacobson, and Marcus.

7.-8. Without error.

9. Without error, as described in the Learning Resources.

10. Without error.

11. Cumulative Goal - 80% accuracy. (note: Abnormal findings resulting primarily from involvement of extrapyramidal, limbic, or brain stem structures need not be mentioned at this time. Findings listed which are adequately justifies anatomically in the answer will be considered correct, even if clinical experience reveals that they seldom accompany the lesion in question.)

LEARNING RESOURCES:

Essential:

1.-3. Willis and Grossman - p. 152-161
Prosected cadavers
Dry (intact) skulls with hinged calvaria
Human brains for dissection
Labelled skull X-rays, aortic arch arteriogram, and carotid arteriograms (correspond to slides I-1,2,3,4,8; II-1,2,3,4)

4. Taveras and Wood - pp. 1.534-1.537

5. Willis and Grossman - p. 153

6. Willis and Grossman - p. 158-159

7. Same as for 1.-3. (see above)

8. Same as for 1-3. (see above and also Table 1)

9a. Taveras and Wood - pp. 1.515-1.518

9b. Taveras and Wood - pp. 1.510-1.523

9c. Taveras and Wood - pp. 1.538-1.544

10. Same as 1.3. (see above)

11. Harrison - pp. 1731-1737
Willis and Grossman - pp. 378-382

Additional:

(Reprint in Library)

1. Truex and Carpenter - pp. 62-74, 80-88

2. CIBA - Vol. 1, Nervous System, pp. 34, 36-38, 114-117

3. Snell - pp. 704-711

4. Curtis, Jacobson, and Marcus - pp. 353, 407-413, 538-573

5. Lusted and Keats - pp. 12-14, 17-21

6. Löfgren, F. Olov - "Vertebral Angiography in the Diagnosis of Tumors in the Pineal Region." Acta radiologica, Vol. 50 (1958), pp. 108-124.

7. Caplan, Louis, R. - "The Frontal-Artery Sign - A Bedside Indicator of Internal Carotid Occlusive Disease." New England J. of Med., Vol. 288 (1973), pp. 1008-1009

ATTACHED TO PROBLEM UNIT II:

Table 1: Intra-cranial Arteries, Veins (including Emissary Veins), and Venous Sinuses

Notes: The Carotid Arteriogram

Personnel:

Dr. Estavillo (Module Leader)
Dr. Lehr
Dr. Levitt
Teaching Assistants

Scheduled Activities:

See schedule.

STUDENT NAME..... Study Group? Yes ☐ No ☐
If Yes, how many in group?_____

MODULE NEURO II 6

ESTIMATED MODULE WORK TIME

	Hours	(STUDENT USE ONLY) Hours
1. Orientation to module and preparation of personal study plan (1-2 hours may be good estimate)	1.0	
2. (A) Reading of *essential* written material (10 pages per hour may be good estimate)	3.0	
(B) Study, synthesis, recitation over reading material (1 hour for every 5 hours of reading time may be good estimate)	1.0	
3. (A) Study of other instructional materials (slides, films, models, etc.)	4.0	
(B) Synthesis and recitation over non-reading material (1 hour for every 5 hours in 3A may be good estimate)	1.0	
Subtotal	10.0	
4. Immediate pretest preparation (cramming). Review, practice, problem-solving, memorization. (1 hour for every 10 hours in subtotal above may be good estimate)	.5	
5. Evaluations (time spent in taking tests)	1.0	
6. Recycles. Include study *and* retest time (1 hour for every hour of evaluation scheduled in 5 above may be good estimate)	.5	
7. Scheduled and non-scheduled instructional events (lectures, seminars, help sessions, discussions, symposia, labs, dissection, clinical rounds)	1.0	
TOTAL	13.0	

NOTE TO STUDENT: This form must be turned in to the Educational Resources office after you have successfully completed the module.

Author: Dr. Lehr
1976 Revision

DOMAIN: Arterial Supply of the Infratentorial Brain

PREREQUISITES: Neuroscience Problem Unit I and Modules II-5, II-6, II-8, II-10, III-1, III-2, and III-3

GOALS:

1. When presented with a fresh brain and cranial vault of a human cadaver, point out and name the arteries (infratentorial only) listed in Table 1 of Module II-6.

2. From memory, draw and label a diagram of the ventral (anterior) view of the brainstem, indicating the relationships between the infratentorial arteries (as listed in Table 1 of Module II-6) and surface structures of the brainstem (as listed in Table 1 of Module III-2).

3. From memory, draw (and label) within outlines of the cranium corresponding to A-P, lateral, and Townes views, the infratentorial arteries (as listed in Table 1 of Module II-6) as they appear (proper locations) on "normal" arteriographic studies.

4. When presented with an X-ray taken during the arterial phase of a vertebral arteriogram, identify the view, describe any abnormality (in position, calibre, etc.) in infratentorial arteries, and name labelled infratentorial arteries (as listed in Table 1 of Module II-6).

5. When presented with a list of structures in the posterior fossa (from structures in Table 2 of Module III-2), describe the arterial supply for each (as listed in Table 1 of Module II-6) and name as many other structures as possible in its vicinity that may be involved because of similar arterial supply. For each structure in pathways involving a cranial nerve or control over states of consciousness (structures preceded by "CN" and "S+W", respectively, in Table 2 of Module III-2), list the probable results in terms of sensory and/or motor abnormalities of the head and neck region or in terms of abnormalities of state of consciousness (including grossly observable, EEG, and EMG findings).

6. When presented with an X-ray taken during the arterial phase of a vertebral arteriogram, identify the view, name labelled infratentorial arteries (as listed in Table 1 of Module II-6), list the abnormal neurologic findings one might expect to find if blockage of each labelled artery occurred at the points designated, and explain the anatomical basis for the abnormal findings.

7. When presented with a list of single or multiple symptoms or signs involving states of consciousness and/or the head (and neck) region, name the potential locations at which damage might cause the findings, naming specific neural structures whenever possible and designating side on which the structure occurs in all cases. For each structure named, give additional findings you might look for if the damage were secondary to an expanding localized lesion. Name the terminal blood supply as specifically as possible and give additional findings you might look for if the damage were secondary to a vascular, localized lesion. For cortical structures, include Brodmann areas. For each set of one or more findings (as presented), rank the alternatives in terms of decreasing likelihood as best you can.

EVALUATION CRITERIA:

1.-3. Self-evaluation.

4. Without error.

5. Arterial supply - at least 90% accurate.
Structures with similar supply - at least 80% complete and accurate.
Results of involvement - at least 80% complete and 90% accurate.

6. Cumulative goal. At least 80% complete and accurate.
(Note: Findings listed which are adequately justified anatomically in the answer will be considered correct, even if clinical experience reveals that they seldom accompany the lesion in question.)

7. Cumulative goal. At least 80% complete and accurate. As applicable, structures at "all" levels, namely, cortical, subcortical, brain stem, and peripheral, should be listed. Blood supply should be described in terms of arteries listed in Table 1 of Module II-6. The rankings of alternatives should be reasonable, as based on anatomic considerations such as spatial contiguity or common blood supply of involved structures.

LEARNING RESOURCES:

Essential:

1.-2. Willis and Grossman - pp. 152-158
Curtis, Jacobson, and Marcus - p. 235 (Appended)

Human brains for dissection
Cadavers for dissection

3.-4. See resources listed under 1.-2. above.

Labelled skull X-rays, arteriograms, pneumoencephalogram, and posterior fossa myelogram (correspond to slides I-1, 2, 3, 4, 8; II-1, 2, 3, 4; III-1, 2, 3, 4)

5. Neuroscience Module III-2

   Harrison - pp. 1736-1744 (See Module II-6)

6. See resources listed under 1.-5. above.

7. Neuroscience Modules I-2, I-3, I-4, II-5, II-6, II-8, II-12, III-1, III-2, III-3, III-4

Additional:

Willis and Grossman - pp. 374-377

Curtis, Jacobson, and Marcus - pp. 350-385

Truex and Carpenter - pp. 63-70, 74-79 (Reprint in library)

CIBA - Vol. 1, Nervous System, pp. 36, 38, 67

Skulls with hinged calvaria

Taveras and Wood - pp. 1.523-1.534, 1.655-1.663 (Reprint in library)

Schmitz, Alfred; Haveson, Samuel; and Duke Hanna - Illustrative Cranial Neuroradiology, 1967, pp. 355-366.

Krayenbühl, Hugo A., and Mahmut G. Yaşargil - Cerebral Angiography, 1968 pp. 66-84, 143-362.

Epstein, Bernard S. - Pneumoencephalography and Cerebral Angiography, 1966, pp. 124-126, 246-265, 284-289.

Nomura, Takayoshi - Atlas of Cerebral Angiography, 1970, Normal Angiogram 2 (opposite p. 56) and pp. 67-72, 80-81, 213, 215-216, 218, 223, 228, 242-271, Normal Angiogram 5 (opposite p. 272)

Weibel, Jorge, and William S. Fields - Atlas of Arteriography in Occlusive Cerebrovascular Disease, 1969, pp. 144-149, 171, 178-179.

Attached to Problem Unit III:

Notes: Introduction to Vertebral Arteriography

Modules III-1, III-2, III-3, III-6

Personnel:

Dr. Lehr (Module Leader)
Dr. Estavillo
Dr. Berkley
Ms. Smith
Teaching Assistants:

Scheduled Activities:

See schedule.

STUDENT NAME..... Study Group? Yes ☐ No ☐
If Yes, how many in group?_____

MODULE NEURO III 4

ESTIMATED MODULE WORK TIME

	Hours	(STUDENT USE ONLY) Hours
1. Orientation to module and preparation of personal study plan (1-2 hours may be good estimate)	1	
2. (A) Reading of *essential* written material (10 pages per hour may be good estimate)	1	
(B) Study, synthesis, recitation over reading material (1 hour for every 5 hours of reading time may be good estimate).....	1	
3. (A) Study of other instructional materials (slides, films, models, etc.).....	1	
(B) Synthesis and recitation over non-reading material (1 hour for every 5 hours in 3A may be good estimate).....	1	
Subtotal.....	5	
4. Immediate pretest preparation (cramming). Review, practice, problem-solving, memorization. (1 hour for every 10 hours in subtotal above may be good estimate).....	1	
5. Evaluations (time spent in taking tests).....	1	
6. Recycles. Include study *and* retest time (1 hour for every hour of evaluation scheduled in 5 above may be good estimate).....	1	
7. Scheduled and non-scheduled instructional events (lectures, seminars, help sessions, discussions, symposia, labs, dissection, clinical rounds).....	1	
TOTAL.....	9	

NOTE TO STUDENT: This form must be turned in to the Educational Resources office after you have successfully completed the module.

Curricular Materials

Sequence I
Carbondale

NEUROSCI VI 5

1976 Revision: Dr. Hunter

DOMAIN: Decorticate, Decerebrate, and High Spinal Preparations
Location and Function of Major Tracts Descending From Brain into Spinal Cord

PREREQUESITES: Neuroscience Modules I-2, I-4, II-5, II-6, II-7, II-12, III-1, III-3, III-4, III-6, VI-3, IV-5, IV-6, V-4, V-5, V-9, VI-3, VI-4

GOALS:

1. For each of the following spinal tracts--lateral corticospinal tract, anterior corticospinal tract, rubrospinal tract, reticulospinal tract, vestibulospinal tract: Locate verbally the functional pathway of which it is a part from beginning to end, mentioning sites of decussation. Also, name adjacent structures at various levels within the CNS, describing briefly the functional role of each one.

2. When presented with a series of cross-sections of the spinal cord, name the segmental level for each one, then locate and name the spinal tracts mentioned in Evaluation Goal 1 that pass through each section. Be very specific (i.e., locate the sacral, lumbar, thoracic, and cervical fibers) with the corticospinal tracts. For the rubrospinal, reticulospinal, and vestibulospinal tracts, indicate clearly their locations relative to the corticospinal tracts.

3. From memory, define or describe briefly in writing the terms in Table 1.

4. From memory, describe briefly in writing or orally how to test for each of the following clinical findings, describe the appearance of the findings, and discuss the functional significance of the findings:

   Babinski sign
   clonus
   clasp-knife rigidity
   grasp reflex

5. From memory, differentiate among a) lower motor neuron, b) pyramidal, c) extrapyramidal, and d) cerebellar lesions by listing the motor findings classically associated with each type.

6. From memory, describe in writing the type of lesion resulting in spinal shock and describe the findings acutely and during recovery, naming them in proper sequence and with approximate time estimates (relative to the time the lesion was incurred).

7. From memory, discuss briefly in writing why decerebrate rigidity has been labelled "gamma rigidity", predict the effect of dorsal root section on the rigidity of muscles innervated by the corresponding ventral roots, and defend your prediction by describing an underlying mechanism.

8. From memory, describe in writing features common to the postures of decorticate and decerebrate rigidity and features that distinguish the two postures.

9. When presented with a list of descriptions of sites of lesions in the CNS (which may include diagrams, verbal descriptions, or presentation of radiographic studies), list the motor abnormalities expected (if any) for each site and state briefly the anatomic basis for each abnormality.

10. When presented with a list of single or multiple neurologic symptoms or signs, name the potential locations at which damage might cause the findings, naming specific neural structures whenever possible and designating side on which the structure occurs in all cases. For each structure named, give additional findings you might look for if the damage were secondary to an expanding localized lesion. Name the terminal blood supply as specifically as possible and give additional findings you might look for if the damage were secondary to a vascular, localized lesion. For cortical structures, include Brodmann areas. For each set of one or more findings (as presented), rank the alternatives in terms of decreasing likelihood as best you can.

EVALUATION:

1.-3. Self-evaluation

4. As described in Essential Learning Resources.

5. As described in Table 2 (attached).

6. As described on p. 666 of Curtis. Jacobson, and Marcus.

7. As described on pp. 669-670 of Curtis, Jacobson, and Marcus. The prediction must be defended by a reasonable mechanism consistent with present-day knowledge in neurophysiology.

8. As described on p. 674 of Curtis, Jacobson, and Marcus.

9. For motor findings below the neck, at least 80% complete and accurate. For other findings, cumulative goal; also at least 80% complete and accurate.

10. For motor findings below the neck, potential locations in the spinal cord and periphery must be considered fully, including additional motor findings and reasoned ranking of alternatives. For other symptoms and signs, cumulative goal. In both cases, at least 80% complete and accurate.

LEARNING RESOURCES:

1. Willis and Grossman - pp. 279-285

2. Truex and Carpenter -pp. 276, 281, 283, 284-286
   Curtis, Jacobson, and Marcus - p. 146

3. Curtis, Jacobson, and Marcus -pp. 661-679
   A medical dictionary

4. DeJong - pp. 503-506, 614-617, 621-626, (quite detailed - pick out required information)

5. Table 2 - Motor Dysfunction Syndromes

6. Curtis, Jacobson, and Marcus - pp. 662-666

7. Curtis, Jacobson, and Marcus - pp. 669-670

8. Curtis, Jacobson, and Marcus - p. 674

9.- 10. Neuroscience Modules I-2, I-3, I-4, II-5, II-6, II-8, II-12, III-1, III-2, III-3, III-4, III-6, IV-1, IV-3, IV-1, IV-2, IV-3, IV-5, IV-6, V-3, V-4, V-5, V-9, VI-2, VI-4, VI-5, VI-6

(Example of findings for Goal 12)

Complaint of progressive weakness in right hand
Weakness, atrophy, and fasciculations of the interossei, thenar, and hypothenar muscles of both hands
Atrophy of both shoulder girdles
Loss of pain and temperature sensation over both upper extremities and over the upper trunk (to the level of the manubrium)
Hyperreflexia in lower extremities
Impairment of vibratory and position sense below the knees

Additional Learning Resources:

Willis and Grossman - pp. 112-113, 273-290

Truex and Carpenter - pp. 274-288

Attached to Problem Unit VI:

Table 1: Terms Relevant to Module VI-5

Table 2: Motor Dysfunction Syndromes

Curtis, Jacobson, and Marcus - p. 146

Faculty:

Dr. Hunter (Module leader)
Dr. Estavillo
Dr. Lehr

Scheduled Activities:

See Schedule.

STUDENT NAME..... Study Group? Yes ☐ No ☐
If Yes, how many in group?_____

MODULE NEURO VI 5

ESTIMATED MODULE WORK TIME

	Hours	(STUDENT USE ONLY) Hours
1. Orientation to module and preparation of personal study plan (1-2 hours may be good estimate)	.5	
2. (A) Reading of *essential* written material (10 pages per hour may be good estimate)	4.5	
(B) Study, synthesis, recitation over reading material (1 hour for every 5 hours of reading time may be good estimate)	1.0	
3. (A) Study of other instructional materials (slides, films, models, etc.)	-	
(B) Synthesis and recitation over non-reading material (1 hour for every 5 hours in 3A may be good estimate)	-	
Subtotal	6.0	
4. Immediate pretest preparation (cramming). Review, practice, problem-solving, memorization. (1 hour for every 10 hours in subtotal above may be good estimate)	.5	
5. Evaluations (time spent in taking tests)	1.0	
6. Recycles. Include study *and* retest time (1 hour for every hour of evaluation scheduled in 5 above may be good estimate)	.5	
7. Scheduled and non-scheduled instructional events (lectures, seminars, help sessions, discussions, symposia, labs, dissection, clinical rounds)	1.0	
TOTAL	9.0	

NOTE TO STUDENT: This form must be turned in to the Educational Resources office after you have successfully completed the module.

Author: Dr. Anthoney

Cumulative Module I

Introduction: Format for Cumulative Modules

The majority of goals making up the curriculum of the S.I.U. School of Medicine are tentatively justifiable as necessary for maintenance and improvement of the health of a population for which our graduates will assume responsibility. Consequently, attempts have been made to present the goals of the curriculum in as clinically relevant a manner as possible. Since most of the clinician's time is devoted to the handling of individual patients with specifiable clinical problems, the units of the curriculum itself strive for a format consistent with the attainment of such competencies. The format of the cumulative modules, therefore, will reflect the generalized model for the working up and treating of clinical problems, just as does the format of the Neuroscience Clinical Cases.

Obviously the realism of the curricular goals, as compared to the tasks of a physician in practice, is limited, especially for beginning medical student, by the amount of material and skills they have presently mastered. As the student progresses, however, he/she should increasingly be able to handle more and more aspects of more and more varied clinical problems. To help enable the student to use present competencies within the framework for which they are ultimately intended, the initial cumulative modules will utilize the same organization and terminology* that later ones might, though he/she may currently be unable to work through, even in rudimentary form, all aspects of a clinical problem.

The cumulative modules will evaluate materials not only from the Neuroscience Block but also from previous and concurrent curricular segments, particularly when they complement the handling of clinical problems utilized to evaluate the Neuroscience materials. Only materials related directly to the Neuroscience Block, however, will be considered in making decisions with regard to passing of the modules.

*The organization and terminology used in the modular format are meant to be consistent with the goals related to the Introduction to Clinical Medicine and a recording system modelled after the Problem-Oriented Record (P.O.R.).

On each evaluation, questions will be referenced back to the module(s) in which the material involved was to have been learned. In this way, the student's performance on the evaluation can hopefully be analyzed to point out particular areas of strength and weakness. The criteria will not be stated in exact percentages ahead of time, but the performance will have to convince the evaluators that most material has been mastered (80-90%?) and that no significant gaps in knowledge or gross misunderstandings exist.

GENERAL MODEL
(for organization of knowledge and skills to be evaluated in cumulative modules)

Divisions in P.O.R. Format	1a)* Given a clinical situation (including a clinical problem and other related information) Do the Following (Actions)
Obtaining Data Base	1b) Emergency and urgency considerations 1c) Clarification of presenting problem (Chief Complaint) 1d) Elicitation of historical information (Background Data, Present Illness, Review of Systems, Past Medical History, Family History, Personal and Social History) 1e) Performance of the physical examination (Routine Examination, Special Procedures) 1f) Ordering and interpretation of routine laboratory tests
Formulating Problem List	1g) Listing of findings and integration into higher-order diagnostic categories
Formulating Initial Plan	1h) Formulation of further diagnostic work-up and treatment plans (including patient education)
Writing Progress Notes (S.O.A.P.)	1i) Listing of additional Subjective findings (original collection by non-clinicians) Listing of additional Objective findings (original collection by allied health personnel) Assessment of situation (review of status of Problem List) Review of status of Initial Plan and changes in Planning

2. Clinical Rationale for each Action (in terms of patient management)	3. Basic Science Explanations for each Action and Related Findings (Data)

*Numbers correspond to the numbers on the evaluation goals

PREREQUISITES: Neuroscience Problem Units I-III
Locomotor Modules 0.10-3.90 (including Pharmacology II)
Block One

GOALS:

1. a) With regard to the following clinical problems (given as chief complaints):

	Symptoms and	Signs	Referrable to
E	dysphagia	anisocoria	
X	diplopia	visual field	Cranial Nerve
A	facial pain	defect	Dysfunction
M		decreased	
P		hearing	
L			
E	one-sided weakness	hemiparesis	
S	inability to see	homonymous	Cerebral Cortical
	objects on one side	hemianopsia	Dysfunction
	numbness on one side	hemianesthesia	(including
E	can't express	dysphasia	subcortical
X	himself	(expressive,	projection
A	can't understand	receptive)	tracts)
M	spoken words		
P			
L	weakness of lower	peripheral facial	
E	face on one side	paresis	
S	drooling	emesis	Brain Stem
	occipital headache	absence of doll's	Dysfunction
	drowsiness	eyes responses	
E			
X	clumsy with one	truncal ataxia	Cerebellar
A	hand	intention tremor	Dysfunction
M	stumble when	dysdiadochokinesis	(including efferent
P	walking		and afferent
L			projections)
E			
S			

b) Be able to assess the patient's condition as emergent, urgent, or routine, and manage any emergent or urgent condition.

Examples

Patient with depressed state of consciousness	Quickly ascertain exact stage of consciousness Quickly examine for evidence of increased intracranial pressure Quickly examine for signs of herniation--uncal or tonsillar
Patient with head injury:	Monitor progression of neurologic symptoms and signs R/O epidural hematoma

c) Be able to clarify the symptoms with appropriate questions and verify the presence of the signs by appropriate procedures (or describe in writing what you would ask or do, respectively),

Examples

Clumsy with right hand--	What makes you feel that your right hand is clumsy?*
Intention tremor--	Have patient perform the finger-to-nose test.

d) Be able to elicit the following information, as appropriate, during the history (or describe in writing what you would ask).

General background--	Age, Sex, Race, Occupation, Marital Status, Religion, Place of Residence

Present Illness (P.I.)--Information relevant to the chief complaint, as noted in Problem Units I-III, especially in the clinical case resources.

Examples

Chief complaint: headache	Would you please point to where it hurts? Could you describe the pain? Is it steady? Does it throb? When do you get these headaches? Etc.

* This may seem like a simple-minded question, but remember that the patient may not be using words the same way you do. Clumsy may bring to mind "uncoordinated" for you, for example; whereas questioning may reveal that the patient's hand is simply "weak." Obviously, failure to pick up such distinctions may lead you astray in your subsequent work-up.

Family history (F.H.)--Information relevant to the chief complaint or other neurologic problems, as noted in Problem Units I-III, especially in the clinical case resources.

Examples

Chief complaint: Headache	Anyone else in your family have headaches? Are they like yours?
Chief complaint: Fainting spells	Anyone in your family ever have low blood sugar? Anyone in your family ever have a stroke? Anyone in your family ever have heart trouble? Etc.

Personal and social history--Information about the patient's life situation, especially as it might be related to the chief complaint or to management of the patient.

Example

Chief complaint: Headache	How are things at work? How are things at home? How's your financial situation? Etc.

e) Be able to carry out the following procedures appropriately during the physical examination (or describe in writing what you would do).

Routine physical examination - adult*

B. Patient sits, facing examiner	Equipment
1. Patient--Observe overall appearance.	
2. Hands/Arms--Inspect nail beds and skin** Palpate muscles** Flex/extend joints**	
3. Head/Face--Inspect configuration Inspect skin and scalp	
4. Eyes--Check visual acuity	Pocket screener (or Snellen Chart)

* To be evaluated only insofar as covered during the Neuroscience Block and Locomotor Block to date. Excerpted from ICM-1 materials for 1973-1974.
** To be evaluated only insofar as covered during Locomotor Block to date.

Examples (cont.)

Chief complaint: "Falling Out" spells	Do you actually become unconscious? Are you aware of anything unusual before you lose consciousness? Has anyone else witnessed one of these spells? Have they mentioned anything to you about what you do during the spells? Could I speak with the person? Etc.

Review of systems (R.O.S.)--Information about the presence of symptoms and signs listed in a) above, especially as related to the chief complaint(s).

Example

Chief complaint: Decreased hearing on the left	Have you noticed anything else unusual? Have you noticed any weakness of your facial muscles? Does saliva tend to drool out of your mouth? Have you had any headaches? Have you had any numbness or funny feeling in your face? Etc.

Past medical history (P.M.H.)--Information relevant to the chief complaint or other neurologic problems, as noted in Problem Units I-III, especially in the clinical case resources.

Examples

Chief complaint: Seizures	Have you ever injured your head? Were there any problems with your delivery? Do you drink alcohol? How much? Have you ever fallen? Have you ever had any growths or tumors? Have you ever had brain surgery? Have you ever been seriously ill? (possible meningitis, subacute bacterial endocarditis, septicemia) Do you get frequent ear infections? What drugs have you taken recently? Have you ever had sugar in your urine? Etc.
Chief complaint: Throbbing headache	Have you ever had high blood pressure? Etc.

accompanied by demonstrable onset of right-sided hemiplegia, right-sided hemianesthesia, and receptive dysphasia	Enter: 1) Multiple symptoms and signs referrable to dysfunction of dominant (left) hemisphere of cerebrum, involving at least the frontal and parietal lobes.

h) Based on the information in items a)-g) above, be able to formulate an initial plan, which includes the following:

Diagnostic work-up--Be able to order appropriately and interpret accurately (within the limits of the goals in the previous curricular materials) the following additional tests and procedures:

Plane films of skull - routine views
EEG
Lumbar puncture
Audiologic tests
Petrous laminagrams
Brain scan
ECHO
Fluorometric determinations
Arteriography (aortic arch, carotid, vertebral)
Pneumoencephalography
Myelography
Isotope cisternography
Consultation or referral to neurologist, neurosurgeon, ENT, ophthalmologist, psychiatrist, audiologist, clinical psychologist

Treatment

Be able to utilize appropriately the following types of treatment (within the limits of the goals in the previous curricular materials):

Drugs: Anti-convulsants
Sedatives
Anesthetics

Physical therapy:

Surgery:

Psychological and social therapy:

Monitoring of patient's health:

Patient education:

Referrals, e.g., to physical therapist, neurosurgeon, orthopedic surgeon, clinical psychologist, psychiatrist, social worker, governmental agencies (e.g., regarding Medicare coverage, Social Security benefits, aid with vocational training for the disabled), etc.

Check pupillary reaction to light--direct and consensual	Pen light
5. Ears--Inspect ears externally and with otoscope	Otoscope
Nose--Inspect nose externally, and septum and turbinates internally	Otoscope
Throat--Have patient open mouth and say "Ah", inspect uvula and palate	Tongue blade Pen light
Test hearing	Wrist watch

C. Examiner moves behind patient

6. Neck--Inspect skin**
Check range of motion**
Have patient shrug shoulders
Have patient place hands above head**
Palpate lymph nodes**

. . . . . .

13. Funduscopic exam--Elicit red reflex — Ophthalmoscope

14. Neurologic--Have patient wrinkle forehead, show teeth, protrude tongue

. . . . . .

F. Patient stands

15. Gait--Have patient walk across room

Neurologic examination (additional to the routine physical examination above). As covered in clinical skills (Neuroscience Modules I-4, II-12, and III-6).

f) Be able to order appropriately and interpret the results accurately for the following routine lab tests

Essentially none, with few exceptions that are directly related to previous Neuroscience or Locomotor modules--e.g., blood sugar level for patient with seizures or episodic loss of consciousness; serum Ca^{++} levels for patient with possible osteomalacia

g) Be able to formulate a problem list based on the information in items a)-f) above, and integrate the symptoms, signs, and lab findings appropriately into higher-order diagnostic categories covered in the Neuroscience and Locomotor Blocks to date.

Example

Patient with sudden right-sided weakness, numbness, and inability to understand speech of others,

i) Based on the results of the procedures formulated under initial plans in h),
be able to write appropriate progress notes, organized in the S.O.A.P. format (Subjective data, Objective data, Assessment of data, and Plan of management).

Subjective data represent information from the patient, family, and friends (i.e. feelings, reactions, and observations).

Objective data represent clinical observations and laboratory findings of the physicians and allied health personnel.

Assessment material explains the significance of subjective and objective data. Here the physician records his thinking on further defining the problem, appraising the progress of the management course, and identifying new problems. It should include the reasons for continuing, changing, or dropping a course of management. The student should specifically be able to draw adequate conclusions regarding diagnoses, etiologies, and mechanisms underlying development of clinical problems insofar as they have been covered by the goals in previous curricular materials.

Examples

In a patient with C.C. of head injury, followed by development over a period of weeks of symptoms and signs possibly referrable to increased intracranial pressure, such additional findings as midline shift of pineal to the right, midline shift to the right as demonstrated by ECHO, decreased amplitude of EEG waves on the left, and an area of abnormally high uptake over the left hemisphere on brain scan, should lead to the conclusion that the patient has a chronic subdural hematoma.

In a patient with C.C. of sudden onset of right-sided weakness and numbness with inability to speak, the visualization of an aneurysm at the bifurcation of the left internal carotid artery, with normal carotid and vertebral angiographic studies otherwise, should lead to the conclusion that the patient's findings were secondary to rupture of the demonstrated aneurysm.

Plan is approached in the same manner as under "Initial Plan." A plan represents the decision to take a specific course of action based upon new data and assessments.

2. The student should be able to justify any actions taken (and not taken) in Goal 1. on the basis of clinical criteria.

Examples

History: The patient with C.C. of headache was asked the location of the headache in order to determine its correspondence to areas of musculature in the head and neck and to determine probable areas of intracranial involvement in case the headache had an intracranial source.

Physical: The patient with C.C. of headache was examined for presence of bruit over the scalp to investigate the possibility of intracranial A-V malformation.

Routine Lab: The patient with a C.C. of episodic loss of consciousness had a blood sugar drawn to investigate the possibility of hypoglycemia or diabetes.

Plan: The patient with a C.C. of severe headache, with a history suggestive of tension headache, a tender area in the occipital area bilaterally with no neurologic findings, normal plane films of the skull and a normal brain scan and EEG (except for increased artifact from EMG activity), was not examined angiographically, as the probability of finding an angiographic abnormality was extremely remote (<<1%) and the procedure would involve considerable expense and a definite, though small, risk.

Plan: The patient with suspected cerebral infarction was not given CO_2 therapy, as experimental studies had shown that arterioles outside the area of injury tended to dilate, shunting blood from the maximally dilated arterioles in the area of injury, and clinical studies had suggested that CO_2 therapy might sometimes lead to deterioration of the patient's condition.

3. The student should be able to explain (within the limits of the goals in the previous curricular materials) the findings (including their etiologies, mechanisms of production, and consequences) and the actions (including their indications, contraindications, rationale for procedural details, benefit-cost considerations, ethical considerations, forensic considerations, etc.) which occurred (or didn't occur) in Goal 1.

4. Within the limits of the goals in previous curricular materials, the student should be able to show competence in areas which are relevant to the practice of medicine but have not yet, for reasons of incomplete exposure of the student to required competencies, been justified by inclusion in Goal 1.

EVALUATION CRITERIA:

1.-4. See Introduction

LEARNING RESOURCES:

1-4. See Prerequisites.

Personnel:

Neuroscience and Behavioral Science teams, aided by other medical school faculty as needed.

Scheduled Activities:

See schedule.

ESTIMATED STUDENT WORK TIME:

Most instructional time should have occurred during preceding modules; however, an additional 8 hours has been scheduled.

Instructional:	8 Hours
Evaluation:	4 Hours
Total:	12 Hours

NEUROSCI (IM II
BSSH NEUROSCI 17

Author: Dr. Anthoney
1976

PREREQUISITES: Neuroscience Problem Units I - VIII (including Cum I*)
Locomotor Block (including Pharmacology II)
Block I

GOALS:

1. a) With regard to clinical problems (given as chief complaints) referrable to dysfunction of the nervous system (including both central and peripheral components, both neuronal and glial elements, as well as associated vasculature and connective tissue) and/or to non-nervous system dysfunction giving rise to abnormal findings during the neurologic history or examination (e.g., pain, muscle weakness),

   b) be able to assess the patient's condition as emergent, urgent, or routine, and manage any emergent or urgent condition.

   c) Be able to clarify the symptoms with appropriate questions and verify the presence of the signs by appropriate procedures (or describe in writing what you would ask or do, respectively).

   d) Be able to elicit the following information, as appropriate, during the history (or describe in writing what you would ask).

      General background--

      Present illness (P.I.)--Information relevant to the chief complaint, as noted in Problem Units I-VIII, especially in the clinical case resources.

      Review of systems (R.O.S)--Information about the presence of symptoms and signs listed in a) above, especially as related to the chief complaint(s).

* In particular, consult Cumulative Module I for introductory comments regarding purpose of Cumulative Modules, Rationale underlying format of Cumulative Modules, summary chart of goal arrangement in Cumulative Modules, and further details and examples for the various goals listed.

Past medical history (P.M.H.)--Information relevant to the chief complaint or other neurologic problems, as noted in Problem Units I-VIII, especially in the clinical case resources.

Family history (F.H)--Information relevant to the cheif complaint or other neurologic problems, as noted in Problem Units I-VII, especially in the clinical case resources.

Personal and social history--Information about the patient's life situation, especially as it might be related to the chief complaint or to management of the patient.

e) Be able to carry out the following procedures appropriately during the physical examination (or describe in writing what you would do).

Routine physical examination - adult*	Equipment
B. Patient sits, facing examiner	
1. Patient--Observe overall appearance	
2. Hands/Arms--Inspect nail beds and skin Palpate muscles Flex/extend joints	
3. Head Face--Inspect configuration Inspect skin and scalp	
4. Eyes--Check visual acuity	Pocket screener (or Snellen Chart)
Check pupillary reaction to light--direct and consensual	Pen light
5. Ears--Inspect ears externally and with otoscope	Otoscope
Nose--Inspect nose externally, and spetum and turbinates internally	Otoscope
Throat--Have patient open mouth and say "Ah", inspect uvula and palate	Tongue blade Pen light
Test hearing	Wrist watch
C. Examiner moves behind patient	
6. Neck--Inspect skin Check range of motion Have patient shrug shoulders Have patient place hands above head Palpate lymph nodes	

. . . . . .

*To be evaluated only insofar as covered during the Neuroscience Block and Locomotor Block. Excerpted from ICM-1 materials for 1973-1974

D. Patient lies supine; examiner stands at right side

. . . . . .

10. Heart--Take blood pressure — B.P. cuff, Stethoscope

. . . . . .

11. Lower Extremities--Palpate muscles
Flex/extend joints
Test plantar flexor reflex — Reflex hammer

E. Patient sits

. . . . . .

13. Funduscopic exam--Elicit red reflex — Ophthalmoscope

14. Neurologic--Have patient:
Wrinkle forehead
Show teeth
Protrude tongue
Extend arms

Test:
Biceps jerk
Ankle jerk
Knee jerk — Reflex hammer

F. Patient stands

15. Gait--Have patient walk across room

Neurologic examination (additional to the routine physical examination above). As covered in clinical skills (Neuroscience Modules I-4, II-12, III-6, IV-3, VI-6, VII-9, and VIII-6).

f) Be able to order appropriately and interpret the results accurately for the following routine lab tests

Essentially none, with few exceptions that are directly related to previous Neuroscience or Locomotor modules--e.g., blood sugar level for patient with seizures or episodic loss of consciousness; serum Ca^{++} levels for patient with possible osteomalacia; CPK Levels for patient with muscle wasting.

g) Be able to formulate a problem list based on the information in items a)-f) above, and integrate the symptoms, signs, and lab findings appropriately into higher-order diagnostic categories covered in the Neuroscience and Locomotor Blocks.

h) Based on the information in items a)-g) above, be able to formulate an initial plan, which includes the following:

Diagnostic work-up--Be able to order appropriately and interpret accurately (within the limits of the goals in the previous curricular materials) the following additional tests and procedures:

Plane films of skull - routine views
EEG
Lumbar puncture
Audiologic tests
Petrous laminagrams
Brain scan
ECHO
Fluorometric determinations
Arteriography (aortic arch, carotid, vertebral)
Pneumoencephalography
Cystometrography
Nerve conduction studies
Electromyography
Tensilon test
Muscle biopsy
Myelography
Isotope cisternography

Consultation or referral to neurologist, neurosurgeon, ENT, ophthalmologist, psychiatrist, audiologist, clinical psychologist

Treatment

Be able to utilize appropriately the following types of treatment (within the limits of the goals in the previous curricular materials):

Drugs:
- Anti-convulsants
- Sedatives-Hypnotics
- General Anesthetics
- Local Anesthetics
- Analgesics
- Anti-psychotics
- Anti-anxiety drugs
- Anti-depressants
- Muscle relaxants
- Sympathomimetics
- Sympatholytics
- Parasympathomimetics
- Parasympatholytics
- L-DOPA

Physical therapy:

Surgery:

Psychological and social therapy:

Monitoring of patient's health:

Patient education:

Referrals, e.g., to physical therapist, neurosurgeon, orthopedic surgeon, clinical psychologist, psychiatrist, social worker, governmental agencies (e.g., regarding Medicare coverage, Social Security benefits, aid with vocational training for the disabled), etc.

i) Based on the results of the procedures formulated under initial plans in h),
be able to write appropriate progress notes, organized in the S.O.A.P. format (Subjective data, Objective data, Assessment of data, and Plan of management).

2. The student should be able to justify any actions taken (and not taken) in Goal 1. on the basis of clinical criteria.

3. The student should be able to explain (within the limits of the goals in the previous curricular materials) the findings (including their etiologies, mechanisms of production, and consequences) and the actions (including their indications, contraindications, rationale for procedural details, benefit-cost considerations, ethical considerations, forensic considerations, etc.) which occurred (or didn't occur) in Goal 1.

EVALUATION CRITERIA:

1-4. See Introduction to Cumulative Module I.

LEARNING RESOURCES:

1-4. See Prerequisites.

Personnel:

Neuroscience and Behavioral Science teams, aided by other medical school faculty as needed.

Scheduled Activities:

See schedule.

ESTIMATED STUDENT WORK TIME:

Most instructional time should have occurred during preceding modules; however, an additional 12 hours has been scheduled.

Instructional:	12 hrs.
Evaluation:	6 hrs.
Total:	18 hrs.

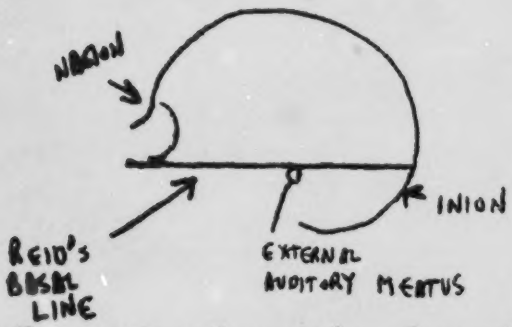
SS

NEUROSCIENCE EVALUATION

CUMULATIVE MODULE II (No. 2) -- BASIC SCIENCE SECTION NAME KEY

1. Diagram and label the inion, nasion, and the anthropological (Reid's) basal line.

I-1
T=3
F=2
S=3



2. Describe a systematic procedure for analyzing the information in a lateral plane film of the skull.

I-1
T=8
F=4
S=7

1. SIZE AND SHAPE
2. THICKNESS AND DENSITY OF CRANIUM
3. SUTURES
4. VASCULAR MARKINGS
5. STRUCTURES ALONG BASE OF SKULL
6. CRANIAL CAVITY

3. View study 1A. Name the blood vessels indicated by the arrows.

I-1
T=2, F=1, S=2

A. INNOMINATE (BRACHIOCEPHALIC) ARTERY

B. RIGHT INTERNAL CAROTID ARTERY

4. List the abnormal findings you might expect in a patient with lesion in the

I-2
T=27
F=8
S=18

a. **right facial nerve** WEAKNESS IN MUSCLES OF FACIAL EXPRESSION ON RIGHT, DECREASED TEARING ON THE RIGHT, DECREASED TASTE ON ANTERIOR 2/3 OF TONGUE (RIGHT SIDE) DECREASED SALIVATION FROM RIGHT SUBMAXILLARY AND SUBLINGUAL SALIVARY GLANDS, ABSENCE OF RIGHT CORNEAL REFLEX

b. **left oculomotor nerve** PTOSIS OF LEFT UPPER EYELID, DISPLACEMENT OF LEFT IRIS DOWNWARD AND LATERALLY, WEAKNESS OF GAZE MEDIALLY, UPWARD, AND DOWNWARD (THE LATTER ONLY IN ABDUCTION), ANISOCORIA (LEFT PUPIL LARGER), ABSENCE OF DIRECT AND INDIRECT (CONSENSUAL) LIGHT REFLEXES ON THE LEFT, ABSENCE OF PUPILLARY RESPONSE TO ACCOMMODATION ON THE LEFT

Name KEY

5. **Explain how brain tissue is able to maintain an R.Q. of near 1.0 during starvation.** BY UTILIZING KETONE BODIES (3-OH BUTYRATE AND ACETOACETATE) AS SUBSTRATES IN CNS ENERGY METABOLISM. THE ABOVE COMPOUNDS BOTH HAVE R.Q.'S NEAR 1.0.

I-4
T=3
F=2
S=3

6. **Describe the possible relationship of the following problems to metabolism of the CNS:**

a. **cyanide poisoning** CN^- COMBINES WITH CYTOCHROME OXIDASE, THE LAST ENZYME IN THE ELECTRON TRANSPORT CHAIN. THE CONSEQUENCE IS A STOPPING OF ELECTRON TRANSPORT TO OXYGEN. ELECTRON CARRIERS IN THE CHAIN ACCUMULATE IN THEIR REDUCED STATE AND GENERATION OF ATP CEASES. THE EFFECT OF CN^- IS AS FUNDAMENTAL AS DEPRIVATION OF OXYGEN AND CAUSES RAPID DAMAGE TO THE BRAIN. OX-PHOS PRODUCES MOST OF THE ATP FOR BRAIN FUNCTION.

I-4
T=6
F=4
S=6

b. **thiamine deficiency** DIETARY THIAMINE IS CONVERTED TO THIAMINE PYROPHOSPHATE IN THE BODY. TPP SERVES AS A COENZYME IN MANY DECARBOXYLATION REACTIONS. TPP SERVES AS A COENZYME IN TWO IMPORTANT REACTIONS OF CARBOHYDRATE METABOLISM—(i) THE PYRUVATE DEHYDROGENASE COMPLEX WHICH CONVERTS PYRUVATE TO ACETYL-CoA (ii) OXIDATION OF α-KETOGLUTARATE TO SUCCINYL-CoA IN THE CITRIC ACID CYCLE. SINCE THE BRAIN IS SO HEAVILY DEPENDENT ON CARBOHYDRATE METABOLISM VIA GLYCOLYSIS AND THE TCA CYCLE FOR ENERGY PRODUCTION, BRAIN FUNCTION IS IMPAIRED WHEN THESE REACTIONS ARE HINDERED DUE TO THIAMINE DEFICIENCY. THIAMINE DEFICIENCY → BERI BERI, CHARACTERIZED BY LOSS OF DEEP REFLEXES, SENSORY CHANGES, ANXIETY, MENTAL CONFUSION.

7. **For each subcellular structure listed below, describe its location and function.**

II-2

a. **Nissl substance (tigroid bodies)**
① MICROSOMES (BASOPHILIC), ② PROTEIN SYNTHESIS, ③ IN SOMA + DENDRITES

T=6
F=3
S=5

b. **neurotubules**
① MICROSKELETON WITHIN CYTOPLASM OF DENDRITES + AXON HILLOCK
② PASSAGE OF NEUROTRANSMITTERS?
③ FUNCTION TO ADHERE CELLS TO EACH OTHER (CELLULAR CROSS-TALK)

8. **Describe the structures that make up the Blood-Brain Barrier.**
CAPILLARY ENDOTHELIUM, BASEMENT MEMBRANE, NEUROGLIAL MEMBRANE (GLIAL PERIVASCULAR FEET)

I-2
T=3
F=2, S=3

9. **Describe the steps involved in synaptic transmission.**

II-3
T=4
F=3
S=4

1. RELEASE OF TRANSMITTER — DEPENDS ON ARRIVAL OF A.P.
2. COMBINATION WITH POST-SYNAPTIC RECEPTOR
3. INITIATION OF POST-SYNAPTIC EVENTS (IPSP OR EPSP)
4. INACTIVATION OF THE TRANSMITTER

10. **Describe the most likely influence of hypocalcemia on neurotransmission and state why the effect is likely to occur.**
↓ Ca^{++} SHOULD INTERFERE WITH NEUROTRANSMISSION BECAUSE Ca^{++} IS NECESSARY FOR TRANSMITTER RELEASE.

II-3
T=2
F=0, S=2

 Name KEY

-6 11. View studies 2A and 2B. If you see any abnormalities, please describe them as precisely as possible. LEFT COMMON CAROTID ARTERIOGRAMS

T=10 2B- FRONTAL VIEW - AN AREA OF ↑ RADIOPACITY, HOMOGENEOUS (RELATIVELY) IN DENSITY, ABOUT 1 CM. IN DIAMETER, WITH SMOOTH, IRREGULARLY SHAPED BORDER, LOCATED IN MIDLINE, ABOUT 3-4 CM. ABOVE HORIZONTAL PORTION OF ANTERIOR CEREBRAL ARTERY

C=4

S=7 2A- LEFT LATERAL VIEW - AREA WITH SAME CHARACTERISTICS AS IN 2A - LOOKS LIKE IT OVERLIES THE CALLOSOMARGINAL ARTERY, ABOUT 1-2 CM. FROM ITS ORIGIN OFF THE ANTERIOR CEREBRAL ARTERY.

PROBABLY REPRESENTS AN ANEURYSM IN THE VESSEL.

-2 12. List the probable results of a lesion in each of the following structures in terms of sensory and/or motor abnormalities of the head and neck region.

T=17 a. right cerebral peduncle PARESIS IN LOWER LEFT MUSCLES OF FACIAL EXPRESSION, PROTRUDED TONGUE DEVIATES TO THE LEFT, POSSIBLY (IF LESION IS HIGH ENOUGH) CONJUGATE DEVIATION OF THE EYES TO THE RIGHT

I=6 b. nucleus ambiguus DYSPHAGIA, DYSPHONIA, IPSILATERAL ABSENCE OF GAG REFLEX, IPSILATERAL INABILITY TO ELEVATE PALATE WITH CONTRALATERAL DEVIATION OF UVULA

S=10

c. right ventral posteromedial nucleus (of thalamus) ABSENCE OF SENSATION (TOUCH, PAIN, TEMPERATURE) OVER LEFT SIDE OF FACE AND SCALP

-2 13. View study # 3A. Assume that the red dot, if it lies over the brainstem, lies ~~XXXX~~ in the medial third of the brainstem. If the dot overlies the brainstem, describe the area of brainstem involved and name 3-5 structures located near the area.

T=7 THE DOT OVERLIES THE VENTRAL, SUPERIOR MIDBRAIN, IN THE MEDIAL ONE-THIRD. STRUCTURES NEARBY INCLUDE ROOTS OF THE OCULOMOTOR +1 NERVE, RED NUCLEUS, +1 FRONTO-PONTINE FIBERS, +1 AND INTERPEDUNCULAR +1 NUCLEUS.

I=3

S=5

-3 14. List the neurologic abnormalities commonly associated with dysfunction of the a) archicerebellum, b) paleocerebellum, and c) neocerebellum.

a) TRUNCAL ATAXIA

T=12 b) ATAXIA OF GAIT

F=5 ABNORMAL HEEL-TO-SHIN TEST (WITH IPSILATERAL HEEL)

S=9 c) INTENTION TREMOR
DYSDIADOCHOKINESIS
REBOUND OVERSHOOT
} IPSILATERAL UPPER EXTREMITY
HYPOTONIA (IPSILATERAL TO LESION)

 Name KEY

IX-1 15. Describe briefly the routes of flow of cerebrospinal fluid from site of production to site of reabsorption into the blood stream.

T=11 F=5 S=9 FROM CHOROID PLEXUSES IN VENTRICULAR SYSTEM : LATERAL VENTRICLES → FORAMEN OF MONRO → THIRD VENTRICLE → CEREBRAL AQUEDUCT → FOURTH VENTRICLE → FORAMINA OF LUSCHKA + MAGENDIE → SUBARACHNOID CISTERNS → GENERAL SUBARACHNOID SPACE TO SUPERIOR CRANIAL VAULT → ARACHNOID GRANULATIONS → SUPERIOR SAGITTAL SINUS

IX-1 16. Describe how to find or construct the venous angle on an arteriogram (frontal view), describe what normal relationships to CNS anatomy make the angle useful for orientation, and give an example of an abnormality that might potentially involve the angle, as well as the significance of the abnormality (i.e., what might it indicate).

T=14 F=5 S=8 THE VENOUS ANGLE IS FORMED BY THE THALAMOSTRIATE VEIN AND THE INTERNAL CEREBRAL VEIN. THEY JOIN AT THE FORAMEN OF MONRO. SINCE THE INTERNAL CEREBRAL VEIN RUNS SAGITTALLY IN THE ROOF OF THE THIRD VENTRICLE NEAR MIDSAGITTAL PLANE (I.E., NEAR THE MEDIAL WALL OF BODY OF LATERAL VENTRICLE AND THE THALAMOSTRIATE RUNS OVER THE LATERAL WALL OF BODY OF LATERAL VENTRICLE, THE ANGLE IS USEFUL FOR LOCATING THE POSITION OF THESE PORTIONS OF VENTRICULAR SYSTEM. IN CASE THE ANGLE IS ABNORMALLY WIDE, IT SUGGESTS DILATION OF THE LATERAL VENTRICLE, INDICATIVE OF HYDROCEPHALUS.

IX-3 17. A 69-yr.-old woman is referred because of an episode of amnesia. Three days previously, she had driven to her niece's house, bringing several gifts for different members of her family. She appeared normal on arrival. After about an hour, however, her family noted that she seemed confused. She recognized her relatives, knew who and where she was, but had no recollection of how she had arrived there. She kept repeatedly and nervously asking how she had gotten to her niece's house. She had no remembrance of her activities earlier that day, but could recall events of days, weeks, months or years ago with complete clarity. She was fully alert and oriented, but very anxious that something was wrong with her mind. Her speech was normal, and there was no evidence of motor or visual abnormality. Eight hours later, she was completely well, but remained amnesic for the events of that day. What type of memory impairment is shown here? [ACUTE RETROGRADE AMNESIA] PROBABLY A FAILURE OF SHORT-TERM MEMORY TO BE TRANSFERRED TO LONG-TERM MEMORY] 1

T=4 F=2 S=3 If there were a lesion involved in this case, where would it most likely be, given that only memory and not other cognitive functions was impaired?

LIMBIC SYSTEM
TEMPORAL LOBE } 1
HIPPOCAMPUS - 2

Does Korsakoff's psychosis seem a likely diagnostic possibility at this point?

T=4 F=2 S=3 Why or why not? NOT LIKELY - 1 NO ANTEROGRADE AMNESIA - 1 EPISODIC MEMORY LOSS ONLY, NO CONCURRENT CONFUSION - 1 NO CONFABULATIONS - 1 NO DRINKING HISTORY - 1 (MAY SUBSTITUTE FOR ONE OF THE ABOVE)

Does senile dementia seem a likely diagnostic possibility at this point? Why or why not?

T=4 F=2 S=3 POSSIBLE BUT NOT LIKELY - 1 SUDDEN ONSET OF SYMPTOMS - 1 SYMPTOMS HAVE APPARENTLY NOT REAPPEARED - 1 SENSORIUM IS CLEAR - 1 ANXIETY IS PRESENT OVER CONFUSION - 1 NO OTHER HIGHER FUNCTIONS LOST - 1 } MAY SUBSTITUTE FOR ONE OF THE ABOVE

Name KEY

I-5 18. Name three classes of psychotropic drugs and the major use for each class.

K=6
F=3
S=5

ANTIPSYCHOTIC - USED IN PSYCHOSES, E.G., SCHIZOPHRENIA
ANTIANXIETY — USED TO REDUCE ANXIETY
ANTIDEPRESSANTS - USED TO TREAT DEPRESSION

I-5 19. Indicate how the antipsychotic drugs might produce their beneficial effect and cause a Parkinsonian-like effect through a common mechanism.

K=4
F=2
S=4

BELIEVED TO BLOCK DOPAMINE RECEPTORS - ASSOCIATED WITH MESOLIMBIC DA - PATHWAY → ANTIPSYCHOTIC EFFECT
ALSO BLOCK DA - RECEPTORS IN STRIATUM → PARKINSONIAN-LIKE SIDE EFFECT

I-3 20. Describe the signs probably demonstrable on examination of a patient with the vagus nerves severed bilaterally at a midcervical level.

T=12
F=1
S=3

DYSPNEA, WITH STRIDOR, ESP. ON INSPIRATION — ↓ RESP. RATE AND RESPIRATORY IRREGULARITIES
LOSS OF COUGH REFLEX, LOSS OF CAROTID SINUS REFLEX
DYSPHONIA
LOSS OF OCULOCARDIAC REFLEX; TACHYCARDIA, WITH IRREGULAR PULSE
↓ BOWEL SOUNDS
ABDOMINAL DISTENTION
POSSIBLE RECTAL IMPACTION

I-3 21. Name the structures in which axons of preganglionic sympathetic neurons synapse?
PARAVERTEBRAL GANGLIA — PREVERTEBRAL GANGLIA — ADRENAL MEDULLA
What is the neurotransmitter at these sites?
T=5
=3
ACETYLCHOLINE
How do these sites differ from those in which axons of preganglionic parasympathetic neurons synapse? LARGE, ORGANIZED GANGLIA, GENERALLY QUITE FAR FROM END-ORGAN
S=4

I-4 22. You are about to treat a depressed patient with pharmacotherapy. You recall that there are two classes of drugs that have been very useful in depression. However, one of these classes of antidepressants is undesirable in the present patient, because he admits to being an avid beer drinker. TYRAMINE in the beer, in the presence of the drug (name the class: MAO-INHIBITORS), could lead to a serious complication, namely, "HYPERTENSIVE CRISIS"

1 & 3

T=7
=2
S=4

If the patient took an overdose of ~~this~~ a drug in the other class of antidepressants, what, given its mechanism of action, might be done to antagonize the effect? (You need not name specific drugs; instead, describe the action(s) a desired drug would have.)

4 ANY ONE

YOU MIGHT BLOCK THE POST-SYNAPTIC RECEPTOR WITH AN α- OR β-BLOCKING AGENT; YOU MIGHT TRY TO PREVENT RELEASE WITH GUANETHIDINE; YOU MIGHT INTERFERE WITH STORAGE - DEPLETE NE - WITH RESERPINE; YOU MIGHT TRY TO INTERFERE WITH NE SYNTHESIS (LESS DESIRABLE)

 Name KEY

VI-5 23. A 50-yr.-old male was in good health until the day before he came to see you. At that time, while carrying a large outboard motor, he ~~[illegible]~~ experienced sudden onset of low back pain, radiating down the back of the left leg. He afterwards had difficulty "straightening up". What autonomic functions would you be sure to ask about? If your questions uncovered autonomic abnormalities, what do you think they would be? What would the anatomic basis for the abnormalities be?

T=7
F=3
S=5

BLADDER AND BOWEL FUNCTIONS
PRESSURE ON SACRAL (S2-S4) SPINAL ROOTS, DECREASING CONDUCTION IN PARASYMPATHETICS EFFERENTS (POSSIBLY IN AFFERENTS AS WELL)
RESULT IN AUTONOMOUS BLADDER (INHERENT CONTRACTIONS OF PARTS OF BLADDER WALL WITHOUT CONTRACTION OF DETRUSOR)
AND IN CONSTIPATION (LACK OF MOTILITY IN RECTUM AND LACK OF RELAXATION OF INTERNAL ANAL SPHINCTER)

VII-1 24. Describe the developmental events which lead to spina bifida.

T=3
F=1
S=3

INCOMPLETE CLOSURE OF NEURAL TUBE (I.E., LAMINA +1 OF VERTEBRAE DO NOT DEVELOP) +1

VII-1 25. List the ~~[illegible]~~ structures derived from the second pharyngeal arch, as well as the name of the nerve supplying them.

T=5
F=2
S=4

CARTILAGE— REICHERT
BONES— STAPES, STYLOID PROCESS
MUSCLES— STAPEDIUS, STYLOHYOID, POST. BELLY OF DIGASTRIC, MUSCLES OF FACIAL EXPRESSION
NERVE— FACIAL
ARTERY— FACIAL

VII-5 26. Differentiate between the type of sensory information transmitted in the dorsal column and that transmitted in the spino-thalamic tracts.

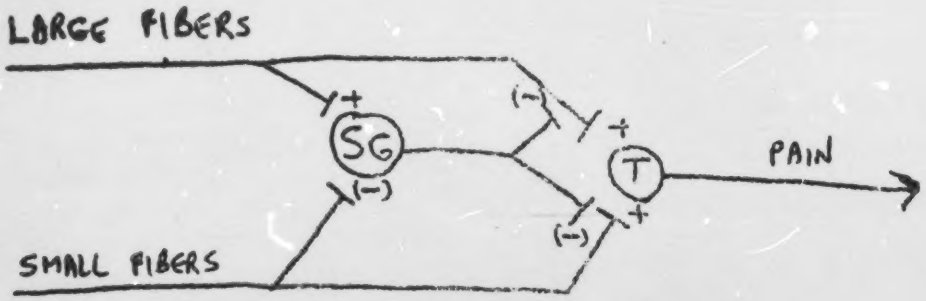
T=6
F=2
S=4

LEMNISCAL	SPINOTHALAMIC
DISCRIMINATIVE TOUCH	PAIN
PROPRIOCEPTION (POSITION SENSE, KINESTHESIA)	TEMPERATURE
	LIGHT TOUCH

Name KEY

III-527. **Diagram the basic neural elements (including interconnections) postulated to underlie the gate control theory of pain and explain briefly what the diagram represents.**

T=7
F=2
S=5



PAIN RESULTS ONLY WHEN TRANSMISSION (T-CELLS) ARE MAXIMALLY ACTIVATED. THIS OCCURS ONLY WHEN THE PATTERN OF STIMULATION RESULTS IN A GREATER PROPORTION OF SMALL FIBERS BEING ACTIVATED. IF MAINLY LARGE CELLS ARE ACTIVATED, THE SG CELLS WOULD BE ACTIVATED IN TURN, THEREBY BLOCKING INPUT (EXCITATORY) TO THE T-CELLS.

III-7 28. **Trace the pathway of impulses from a spot of light focussed on the extreme nasal portion of the left retina to the visual cortex.**

T=11
F=6
S=9

RODS (RECEPTORS)
↓ (HORIZONAL, ETC, POSSIBLE)
BIPOLAR CELLS
↓
GANGLION CELLS
↓
OPTIC NERVE
↓
OPTIC CHIASM (CROSS OVER TO RIGHT SIDE)
↗
OPTIC TRACT
↑
LATERAL GENICULATE
↑
OPTIC RADIATIONS
↑
VISUAL CORTEX (BRODMANN AREA 17)

What type of receptor would you expect to be predominant in that portion of the retina?

RODS

Name: KEY

29. Describe the events of neuromuscular transmission, starting with the ~~arrival~~ arrival of the nerve action potential and ending with depolarization of the sarcolemma.

VIII-2

T=4
F=2
S=4

DEPOLARIZATION OF NERVE TERMINAL
MOVEMENT OF ACh VESICLE TO NERVE TERMINAL MEMBRANE +
RELEASE OF CONTENT INTO SYNAPTIC CLEFT
COMBINATION OF ACh WITH POST-SYNAPTIC RECEPTORS
↑ PERMEABILITY TO ALL SMALL IONS → EPP
SUMMATION OF EPP's → AP IN MUSCLE (SARCOLEMMA)

30. Describe the effects of depolarization of the sarcolemma on mobilization of calcium ions.

VIII-1
T=3
F=2
S=3

① THE DEPOLARIZATION OF SARCOLEMMA (POST-SYNAPTIC MEMBRANE)
TO ② TRANSVERSE TUBULES
TO ③ TERMINAL CISTERNAE OF SARCOPLASM RETICULUM → RELEASE OF Ca^{++}

31. What is the role played by calcium in the skeletal muscle contractile process?

VIII-1
T=3
F=1
S=2

① REQUIRED FOR THE RELEASE OF ACh AT THE SYNAPSE (OPTIONAL)
② REQUIRED FOR ATPase ACTIVITY
③ REQUIRED TO BRING $(MYOSIN)^-$ + $(ACTIN)^-$ CLOSER TOGETHER

32. Differentiate among a) lower motor neuron, b) pyramidal, c) extrapyramidal, and d) cerebellar lesions by listing the motor findings classically associated with each type.

VIII-5

T=20
F=8
S=14

SEE TABLE 2 IN MODULE VIII-5

NEUROSCIENCE EVALUATION 4 JAN 1975

CUMULATIVE MODULE II (No. 2) -- CLINICAL CASE SECTION NAME KEY

1. Mr. Jeremy Redd, a ~~HOSPITAL~~ 64-yr.-old white male, presents in the Emergency Room while you are on duty, complaining of severe dizziness. You have several other ill patients to attend to as well. What questions (state three) might you ask him quickly to ascertain how rapidly you will need to collect your initial data base on him (i.e., to ascertain whether his problem is emergent or urgent in any regard)? For each question, state the clinical rationale (i.e., what's the potential clinical significance of his answer?).

1. a) DURATION OF DIZZINESS?

   b) IF OF SUDDEN ONSET WITHOUT PREVIOUS HISTORY, IMPLIES EMERGENT PROBLEM OF VASCULAR OR INFECTIOUS ~~ORIGIN~~ ETIOLOGY

2. a) ANY HEADACHE, ESP. IF SEVERE? STIFF NECK? DOUBLE VISION?

   b) IF SO, POSSIBLY INCREASED INTRACRANIAL PRESSURE OR SUBARACHNOID BLEED

3) a) IS HE NAUSEATED, ESP. ON CHANGING FROM HORIZONTAL POSITION?

   b) ESTABLISHES SEVERITY OF DIZZINESS, THOUGH IT MAY ALSO INDICATE INCREASED INTRACRANIAL PRESSURE.

2. What maneuvers (state three) might you perform on Mr. Redd as you ask the questions in 1., in order to ascertain how rapidly you will need to collect your initial data base on him? For each maneuver, state the clinical rationale (i.e., what's the potential clinical significance of your findings?).

OMIT QUESTION 2.

T=6

F=2

=4

Name KEY

3. You realize that dizziness is a vague term and may cover a multitude of subjective phenomena. Name some (not more than three) fundamentally different classes of symptoms that might be described by a patient as dizziness, differentiating them from each other briefly.

E.G.

T=6 1) VERTIGO (SENSATION OF PATIENT OR ENVIRONMENT SPINNING) – IMPLIES VESTIBULAR DYSFUNCTION

F=2 2) IMBALANCE = (DIFFICULTY WALKING) – CAN SUGGEST NOT ONLY VESTIBULAR, S=4 BUT ALSO CEREBELLAR, KINESTHETIC, BASAL GANGLION-RELATED, ETC. PROBLEMS

3) LIGHT-HEADED (VERY DIFFICULT TO CHARACTERIZE – "FLOATING AWAY" OR "ABOUT TO FAINT" FEELING) – MAY SIGNIFY DECREASED BLOOD PERFUSION OF CNS, ANXIETY, ETC.

4. Satisfied that you can handle the collection of Mr. Redd's data base in a routine manner, you leave him to take care of an urgent problem elsewhere. When you return, what questions (state three not given in 1. above) about the properties of the dizziness itself might you ask? For each question, state the clinical rationale.

E.G.

T=6 1) a) WHAT BRINGS ON THE DIZZINESS OR IS IT CONSTANT?

F=2 b) CHANGE OF POSITION, AS FROM LYING TO STANDING, SUGGESTS VASOMOTOR S=4 PROBLEMS, WHILE PRODUCTION BY RAPID HEAD MOVEMENTS COULD SIGNIFY PERIPHERAL VESTIBULAR DYSFUNCTION OR NECK MUSCLE INJURY (CERVICAL VERTIGO); CONSTANT PRESENCE SUGGESTS BRAINSTEM PROBLEM.

2) a) WHAT MAKES IT BETTER?

b) RELAXATION – SUGGESTS ANXIETY

KEEPING HEAD IMMOBILE – SEE 1b. FOR DETAILS

3) a) IS IT INTERMITTENT OR CONSTANT?

b) INTERMITTENT IS ASSOCIATED WITH LABYRINTHINE DYSFUNCTIONS SUCH AS MENIERE'S DISEASE OR INTERMITTENT BRAINSTEM ISCHEMIA

CONSTANT – AS IN CHRONIC DISEASE OR INFECTION OF INNER EAR, EXPANDING MASS LESION, ETC.

 Name KEY

5. What questions (state three not given in 1. above) related to Mr. Redd's problem but not directly about the dizziness itself might you ask? For each question, state the clinical rationale.

E.G.—

T=6 1) a) ANY PROBLEM WITH HEARING?

b) ASSOCIATED INVOLVEMENT OF PETROUS BONE OR AUDITORY DIVISION OF VIII NERVE POSSIBLE— INCREASES SUSPICION OF PERIPHERAL PROBLEM

T=3 S=5 2) a) EVER HAD ANY PROBLEM WITH YOUR HEART?

b) CERTAIN TYPES OF PULSE IRREGULARITIES MIGHT RESULT IN TRANSIENT ISCHEMIA OF CNS, PRODUCING FEELINGS DESCRIBED AS "DIZZINESS"

3) a) ANY HISTORY OF "STROKE" IN YOUR FAMILY? DIZZINESS OF OTHER ORIGIN?

b) ESTABLISH POSSIBLE GENETIC PROPENSITY FOR THE PROBLEM— ATHEROSCLEROSIS, MENIERE'S DISEASE, ETC.

6. During the history, you find out that Mr. Redd's dizziness
   a) Came on suddenly earlier in the evening.
   b) Was immediately very severe and remained so, being so bad he could not sit up.
   c) Occurred once about 3 mo. ago, but was less severe then and lasted only about a half-hour.

Of what clinical significance are ~~IX~~ a) and b)?

IMPLIES ACUTE, SEVERE DYSFUNCTION AND b) ESPECIALLY SUGGESTS RELATION TO POSITION. THIS IMPLIES VESTIBULAR SYSTEM, WITH ETIOLOGY PROBABLY BEING VASCULAR, INFECTIOUS, OR TRAUMATIC.

T=3 S=2

Of what clinical significance is c)?

S=3 INTERMITTENT PROBLEM TO SOME DEGREE AND SUGGESTS VASCULAR ETIOLOGY OR EARLY DEGENERATIVE DISEASE. DOUBT MASS LESION OF EXPANSIVE TYPE.

Name KEY

7. During a lumber tap, bleeding is apparently not just secondary to a traumatic tap if, when the CSF sample is spun down, the supernatant is XANTHOCHROMIC, i.e., YELLOW in color. T=2

8. A patient has a small acoustic neuroma. What two cranial nerves are most likely involved and why? T=5 F=3 S=4

IPSILATERAL FACIAL AND STATO ACOUSTIC (VII + VIII)

ACOUSTIC NEUROMAS USUALLY ARISE FROM SCHWANN CELLS SURROUNDING FIBERS OF C.N. VIII — MOST OFTEN IN VICINITY OF INTERNAL ACOUSTIC MEATUS FACIAL NERVE ALSO EXITS FROM INTRA-CRANIUM THROUGH INTERNAL ACOUSTIC MEATUS

9. If you suspected that a patient had a small acoustic neuroma and the petrous bone tomograms were inconclusive, what additional X-ray study might you order? T=1

POSTERIOR FOSSA MYELOGRAM OR PNEUMOENCEPHALOGRAM

10. One of your patients undergoes a left carotid arteriogram.. The procedure goes smoothly. Later that day, however, he complains of trouble breathing and a mass is noted in the lower anterior neck. The mass is probably a HEMATOMA. T=1 ~~POSTERIOR FOSS~~

F=2
S=4

NEUROSCIENCE EVALUATION 4 JAN 1976

CUMULATIVE MODULE II (No. 2) - CLINICAL [illegible] NAME KEY

1. With damage of one vestibular nerve, what findings would you expect to note during the physical examination?

T=8 NYSTAGMUS ON GAZE TO THE CONTRALATERAL SIDE, THE SLOW COMPONENT
BEING TO THE IPSILATERAL SIDE
F=3 STAGGERING GAIT, TENDING TO FALL TO THE IPSILATERAL SIDE,
S=6 PAST-POINTING TO IPSILATERAL SIDE WITH CONTRALATERAL UPPER EXTREMITY
(EYES CLOSED, OF COURSE)
(IF COLD WATER PLACED IN CONTRALATERAL EXTERNAL
AUDITORY MEATUS, TEND TO DECREASE AMPLITUDE OF ABOVE FINDINGS)

2. List the questions you would ask to screen a patient for orientation and memory.

EG. - ORIENTATION -

T=07 (1) PURPOSE - WHY ARE YOU HERE?
(1) PERSON - ~~NAME~~ WHAT'S YOUR NAME?
F=2 (1) TIME - WHAT'S THE TIME OF DAY, DAY OF WEEK, DATE, MONTH, SEASON,
S=4 YEAR?
(1) PLACE - WHERE ARE YOU NOW?

MEMORY -

(1) IMMEDIATE - I'D LIKE YOU TO REPEAT THESE NUMBERS FOR ME.
(1) RECENT - WHAT DID YOU HAVE FOR BREAKFAST? I'D LIKE YOU TO REMEMBER THESE 3 WORDS - ... - I'LL ASK FOR THEM LATER
(1) REMOTE - WHEN WERE YOU BORN, MARRIED, CHILDREN BORN?

INSTEAD OF ONE OF THESE (1) - INDICATION THAT ONE USES DIFFERENT QUESTIONS TO TEST IMMEDIATE, RECENT, + REMOTE MEMORY

3. Go to room 315 and perform the following procedures: (Bring your black bag)

a) Examination of trigeminal nerve function: TEST DISTRIBUTION PROPERLY, FOR LIGHT TOUCH, PIN PRICK - COMPARE BOTH SIDES + IPSILATERAL DIVISIONS. TEST CORNEAL REFLEXES. TEST JAW STRENGTH (TONGUE DEPRESSOR) - TEST STRENGTH OF JAW DEPRESSION, LATERAL EXCURSION, MOUTH OPEN IN MIDLINE.

T=26 b) Examination of cortical sensations in hands and forearms TWO-POINT
=14 DISCRIMINATION, STEREOGNOSIS, GRAPHESTHESIA, POSITION SENSE - COMPARE BOTH
S=20 SIDES AND IPSILATERAL DERMATOMAL AND NERVE DISTRIBUTIONS

c) Examination of motor strength in sternocleidomastoids, deltoids, and triceps surae ACCURATE POSITIONING, COMPARISON OF SIDES

PERFORMED ON EVALUATOR

+3 +3

FOR ALL THE ABOVE, EMPHASIS ON TECHNIQUE RATHER THAN VERBAL RATIONALE.

115

Name KEY

4. (To be answered only by students not taking the Basic Sciences section)
List the abnormal findings you might expect in a patient with lesion in the

a. right facial nerve

b. left oculomotor nerve

SEE PAGE 1 (QUESTION 4) OF BASIC SCIENCES SECTION

NEUROSCIENCE EVALUATION 4 JAN 1976

CUMULATIVE MODULE II (No. 2) -- CUMULATIVE SECTION NAME KEY

1. If syringomyelia were to affect only the central one-third (see schematic diagram) of the diameter of the thoracic spinal cord at the T_4, T_5, and T_6 levels, what would be the motor and sensory impairments (if any) above, below, and at the level of the lesion. Be as specific and complete as possible.

T=10
F=7
S=9

6 PTS. 1. AFFECTED DECUSSATIONS OF LATERAL SPINOTHALAMICS GIVE BILATERAL PAIN AND TEMPERATURE DEFICIT IN NEXT LOWER DERMATOMES (ABOUT T_6-T_9)

2 PTS. 2. SLIGHT SPASTICITY AT LEVEL OF LESION DUE TO DECUSSATION OF ANT. CORTICOSPINAL

1 PT. 3. DEEP FIBERS OF DORSAL FUNICULUS MAY GIVE SOME LOSS OF VIBRATORY SENSE, PROPRIOCEPTION, ETC., BELOW LESION

1 PT. 4. GOOD REASONING FOR OTHER TANGENTIAL PHENOMENA.

 Name KEY

2. A patient presents with absent ankle jerks but 2+ knee jerks. If a cauda equina lesion is present, it apparently involves nerve roots only up to the (S2/S1/L5/L4/L3-- circle the appropriate one) level. If so, one would expect to find loss of sensation in the following distribution:

T=8
F=3
S=7

POSTERIOR THIGHS, POSTERIOR AND ANTERO-LATERAL SURFACES OF LOWER LEGS, ALL OF EACH FOOT

and most weakness of (dorsiflexion of the feet/plantar flexion/flexion of the knee/flexion of the hip-- circle the appropriate one(s)). One would/would not (circle the appropriate one) also expect urinary retention.

3. You have been asked to help evaluate a class of extremely capable first year medical students on some basic points regarding neuroanatomic diagnosis. You decide to stress some basic differentiating points, and, thus, ask the following question.

Findings include absence of pain and temperature on one side below the neck, with sensory deficits referable to a cranial nerve on the opposite side. This suggests a lesion where? Be as specific as possible, supporting your conclusion with names and locations of the structures involved.

T=22
F=5
S=11

ABSENCE OF PAIN AND TEMPERATURE ON ONE SIDE BELOW THE NECK SUGGESTS INVOLVEMENT OF THE LATERAL SPINOTHALAMIC TRACT ON THE OPPOSITE SIDE. SENSORY DEFICITS ON THE OPPOSITE SIDE REFERIBLE TO A CRANIAL NERVE SUGGEST A LESION IN THE BRAINSTEM ON THE SIDE OF THE CRANIAL NERVE DEFICIT, SINCE THE SPINOTHALAMIC TRACT WOULD ALSO LIE ON THAT SIDE. THE MAJOR SENSORY NERVES IN THE HEAD (EXCLUDING I AND II) ARE THE TRIGEMINAL, NERVUS INTERMEDIUS, STATO-ACOUSTIC, AND THE IX, X, XI COMPLEX LEADING INTO THE NUCLEUS SOLITARIUS. SINCE ALL OF THE PRIMARY NUCLEI (CHIEF SENSORY OF V, COCHLEAR NUCLEI, VESTIBULAR NUCLEI, DESCENDING NUCLEI OF V, AND SOLITARY NUCLEUS) AND NERVE ROOTS LIE LATERALLY, AS DOES THE SPINOTHALAMIC TRACT, THE LESION WOULD MOST LIKELY BE IN THE LATERAL BRAINSTEM. SINCE, BY THE TIME THE MIDBRAIN IS REACHED, SENSORY PATHWAYS FOR CRANIAL NERVES (E.G, TRIGEMINOTHALAMIC TRACTS, LATERAL LEMNISCI) TEND TO HAVE DECUSSATED AT LEAST PARTIALLY, THE LESION WOULD MOST LIKELY LIE IN THE PONS OR MEDULLA, POSSIBLY EVEN IN THE UPPER CERVICAL CORD (DESCENDING TRACTS AND NUCLEI OF V).

Name KEY

T=13
F=5
S=8

4. A patient presents with the following symptoms:
   (a) bilateral occipital throbbing headaches for three months, progressively increasing in frequency and intensity, and tending to be worse in the middle of the night or on awakening in the morning.
   (b) tendency to stumble as he walks for past three months.
   (c) tendency to knock things over with left hand for past ~~XX~~ one month.

On physical examination, he is found to have an ataxic gait, inability to perform heel-to-shin smoothly with left leg, and several abnormalities of the left upper extremity, including intention tremor, dysdiadochokinesis, and presence of the rebound phenomenon.

How would you integrate these findings? In other words, what statements do you feel you can make as to probable etiology for and mechanism of production of the findings? Be as specific as possible, both anatomically and otherwise, but do not indulge in poorly grounded speculation.

RAPID, BUT GRADUAL, DEVELOPMENT (OVER 3 MO.) OF FINDINGS POSSIBLY REFERABLE TO INCREASING PRESSURE IN POSTERIOR FOSSA, WITH FOCAL FINDINGS INDICATIVE OF LESION IN THE LEFT ANTERIOR AND POSTERIOR LOBES OF THE CEREBELLUM AND WITH SUBSEQUENT STRETCHING OF PAIN-SENSITIVE STRUCTURES, SUCH AS THE MENINGES OVER THE FLOOR OF THE POSTERIOR FOSSA AND AROUND THE TRANSVERSE AND SIGMOID SINUSES.

THE FACT THAT THERE ARE NO LONG TRACT SIGNS OR CRANIAL NERVE DYSFUNCTIONS YET SUGGESTS THAT THE INCREASED PRESSURE HAS PERHAPS ALSO DEVELOPED GRADUALLY, THE FOCAL FINDINGS BEING PERHAPS SECONDARY TO FOCAL DESTRUCTION RATHER THAN TO GENERALIZED PRESSURE EFFECTS.

SINCE THERE IS NO HISTORY OF SUDDEN INCREASES IN DYSFUNCTION, APPARENTLY NO SUDDEN ARTERIAL ISCHEMIA (E.G., THROMBOTIC EPISODE) OCCURRED. A FOCAL LESION WOULD SEEM TO MAKE THE POSSIBILITY OF SUBDURAL OR SUBARACHNOID HEMORRHAGE LESS LIKELY THAN A MORE LOCALIZED PROCESS, SUCH AS AN ABSCESS OR NEOPLASM. LACK OF SIGNS OF MENINGEAL IRRITATION (E.G., STIFF NECK) ALSO SUGGESTS ABSENCE OF GENERALIZED MENINGEAL IRRITATION, AS MIGHT BE PRESENT WITH MENINGITIS OR BLOOD IN THE MENINGES. THE MASS (IF PRESENT) MAY BE QUICKLY EXPANDING, BUT MAY ALSO BE RELATIVELY SLOW-GROWING AND SIMPLY DIDN'T CAUSE ANY NOTICEABLE PROBLEMS TILL IT ATTAINED A LARGE SIZE.

 Name_____

5. (excerpted from pp. 31-32 in "Neurologic Clinicopathological Conferences of the Massachusetts General Hospital" by B. Castleman and E. P. Richardson, Jr. (1968). Boston: Little, Brown and Company)

Presentation of Case*

First admission. A fifty-eight-year-old woman entered the hospital because of headache and vomiting.

Six days previously she had the onset of a bitemporal and occipital headache at the end of a busy day. On the following morning the headache was worse, and during the day blurring of vision and diplopia developed. Three days before admission she stumbled and fell while walking. She became severely nauseated and vomited several times. On the day before entry she became drowsy, sluggish in conversation and responses and somewhat confused. The headache persisted, with varying intensity, and intermittent vomiting continued.

The patient's general health had been excellent. She had always been left-handed. At the age of twenty-six years she underwent a thyroidectomy and thereafter had occasional periods of fatigue and lassitude that responded well to small doses of thyroid.

On physical examination the patient was somewhat obese. Although conscious and cooperative, she was drowsy, dull and inaccurate about dates. The visual acuity and fields were normal. She complained of diplopia on attempting to read, but none could be demonstrated with red-glass testing. The optic fundi were normal. The right eye was slightly prominent as compared with the left. There was a very slight degree of right lower facial weakness. Tests of strength and coordination of the limbs were normally performed. The tendon jerks were slightly more active in the right arm and leg than the left; the right plantar reflex was extensor, and the left was uncertain. Sensation, including sensory discrimination, was normal. The heart, lungs and abdomen were normal.

The temperature was 98.6°F., the pulse 84, and the respirations 16. The blood pressure was 116 systolic, 65 diastolic.

Urinalysis was negative. The white-cell count was 8400, with a normal differential, and the hemoglobin was 13.6 gm. per 100 cc. The nonprotein nitrogen was 21 mg., the fasting blood sugar 116 mg., and the cholesterol 250 mg. per 100 cc. No bromides were found in the serum. The basal metabolic rate was −18 per cent. An x-ray film of the chest was normal except for bilateral cervical ribs. X-ray films of the skull showed irregular thickening of the inner table of the frontal bone bilaterally; there were small lacunae in the temporal and occipital regions that were interpreted as venous lakes, but the bones of the vertex were otherwise normal, and the sella turcica and clinoid process were intact; the pineal body was not visualized. Lumbar puncture showed a spinal-fluid pressure of 150 to 160 mm.; the fluid was clear and colorless and contained 1 lymphocyte per cubic millimeter and had a protein content of 41 mg. per 100 cc.; the Wassermann test was negative.

The patient rapidly became asymptomatic and was discharged on the seventh hospital day.

Second admission (two years later). In the interim she was active and well. Three weeks before admission the frontal and occipital headaches recurred. She became "dopey" and mentally slow but was better after two days. Three days before entry the frontal headache returned and became constant. On the next day constant nausea and repeated vomiting developed, and she again became drowsy and mentally dull.

On examination she was drowsy and very slow in her responses but could answer simple questions correctly. The eye findings were unchanged. There was slight ptosis of the right upper eyelid, but the pupils were equal and of normal size and reacted briskly to light and on attempted convergence. Convergence was poor,

but the other ocular movements were normal. Slight right facial weakness was again observed. With the arms outstretched the right drifted downward; otherwise, there was no definite weakness in the limbs. The arm jerks were brisker on the right side, the abdominal reflexes were brisker on the left, and the knee and ankle jerks were equal and normally active. Both plantar reflexes were variable. Sensation was normal throughout, including sense of passive movement and stereognosis. The general physical findings were unchanged.

The temperature, pulse and respirations were normal. The blood pressure was 160 systolic, 70 diastolic.

Urinalysis was negative. The white-cell count was 12,600, and the hemoglobin 13.0 gm. per 100 cc. The x-ray studies showed no change except for calcification of the internal carotid arteries. An electroencephalogram showed slow-wave activity in the left frontal and parietal regions extending across the midline to the right in the central region; in the left frontal region there were spike-like, fast-slow complexes; the remainder of the record was not remarkable. Lumbar puncture showed a spinal-fluid pressure of 150 mm. and yielded clear fluid containing 10 red cells per cubic millimeter and with a protein content of 60 mg. per 100 cc.

The patient gradually became mentally clear. The slight weakness in the right arm disappeared; the right plantar reflex became extensor, and the left became flexor. The other neurologic findings remained unchanged. She was discharged on the tenth hospital day.

Third admission (two months later). The occipital headaches recurred intermittently, usually at night or in the early morning. The patient's gait became unsteady, with deviation to the right. Urinary urgency occurred, with occasional incontinence. Otherwise, she was well in the interval and had done a large amount of reading, apparently without visual impairment or difficulty in comprehension. She returned to the hospital for re-evaluation.

On physical examination her responses were slow, but she was mentally clear. The right hand was slightly clumsy in fine movements, but there were no other motor abnormalities. The tendon reflexes were brisker on the right side, and the abdominal reflexes were absent on the right; the right plantar reflex was extensor, and the left was normal. The blood, urine and electroencephalographic findings were unchanged. She was discharged on the fourth hospital day.

Fourth admission (one month later). There was no change in her state until the night before admission, when she suddenly became incontinent of urine and vomited two or three times. She rapidly became drowsy and then unconscious. No convulsions were observed.

The patient was comatose. The pupils were 3 mm. in diameter bilaterally and reacted to light. The orbiculares oculorum were flaccid bilaterally, and there was no facial asymmetry. The neck was supple. There were occasional spontaneous semipurposive movements of the left limbs, but the right limbs moved only on painful stimulation. Slight increase of resistance to passive movement in the right arm and leg was found. The tendon reflexes were equal and moderately active, the abdominal reflexes were absent and the plantar reflexes were bilaterally extensor.

The temperature was 98.6°F., the pulse 85, and the respirations 20. The blood pressure was 155 systolic, 85 diastolic.

X-ray films of the skull showed decalcification of the posterior clinoid processes. Left internal carotid arteriograms showed incomplete filling of the left anterior cerebral artery and downward displacement of the left middle cerebral artery.

On the fifth hospital day an operation was performed.

 Name KEY

5. (Cont.) Try your hand at reasoning through this case, putting emphasis on the neurologic findings, what they seem to indicate separately, and how they can best be integrated. As always, be specific as possible and make the reasoning behind your statements explicit. If particular aspects of the case puzzle you, feel free to say so, again being careful to explain why they seem puzzling.

FIRST ADMISSION —

Rx1 — 1) BITEMPORAL AND OCCIPITAL HEADACHES — 6 DAYS

GIVEN THE LATER PROGRESS OF FINDINGS, SUGGESTS INTRA-CRANIAL PROBLEM; THOUGH ITS BEGINNING AT END OF "BUSY DAY" SUGGESTS POSSIBLE ROLE FOR "TENSION." LOCATION SUGGESTS INVOLVEMENT OF STRUCTURES BOTH SUPRA(TEMPORAL) AND INFRA-(OCCIPITAL) TENTORIALLY.

T > 100

CUM SUM — F = 8, S = 16

2) BLURRING OF VISION — 5 DAYS

DIPLOPIA

BLURRING POSSIBLY DUE TO DEVELOPMENT OF DIPLOPIA, WHICH, IN TURN, MAY BE DUE TO SPECIFIC LESIONS IN PATHWAYS OF OCULOMOTOR OR ABDUCENS, BUT MORE LIKELY AN EFFECT OF INCREASED INTRA-CRANIAL PRESSURE (ON 6TH NERVE, PAPILLEDEMA)

CUM INT — F = 6, S = 12

3) STUMBLING + FALLING — 3 DAYS

GIVEN THE OTHER FINDINGS WERE ALL SUGGESTIVE OF PATHOLOGY ABOVE THE NECK, THE STUMBLING + FALLING COULD INDICATE INVOLVEMENT OF MOTOR AREAS OR TRACTS ASSOCIATED WITH CEREBELLAR HEMISPHERES OR PRECENTRAL GYRUS; HOWEVER, THE PROBLEM WITH VISION (2) OR THE DEVELOPING PROBLEM WITH DROWSINESS + CONFUSION (5) MAY HAVE PLAYED A MAJOR ROLE.

4) INTERMITTENT SEVERE NAUSEA + EMESIS — 3 DAYS

AGAIN, THOUGH POSSIBLY DUE TO LOCALIZED INVOLVEMENT, E.G., IN MEDULLA, IT IS A COMMON FINDING WITH INCREASED INTRA-CRANIAL PRESSURE.

5) DROWSY, SLUGGISH IN RESPONSES, CONFUSED — 1 DAY

GENERAL SYMPTOMS, USUALLY INDICATIVE OF AN ANATOMICALLY DIFFUSE PROBLEM, SUCH AS CEREBRAL EDEMA OR INCREASED INTRA-CRANIAL PRESSURE OF OTHER ETIOLOGY.

Rx: — 6) DROWSY, DULL, INACCURATE ABOUT DATES — COMPATIBLE WITH 5) ABOVE.

7) NO DEMONSTRABLE DIPLOPIA (?)

8) NORMAL FUNDI, I.E., NO PAPILLEDEMA (?)

9) RIGHT EYE SLIGHTLY PROMINENT — POSSIBLE SPACE-OCCUPYING LESION IN OR BEHIND (R) ORBIT — ~20-30% CHANCE IT'S ON DOMINANT SIDE, SINCE SHE'S LEFT HANDED.

10) (R) LOWER FACIAL WEAKNESS, TENDON JERKS SLIGHTLY MORE ON (R), (R) PLANTAR RESPONSE EXTENSOR, ABSENCE OF (R) WEAKNESS BELOW NECK —

KEY

SUGGESTS SLIGHT INVOLVEMENT OF CORTICOSPINAL TRACTS ON THE LEFT ABOVE THE PONS (I.E., ABOVE DECUSSATION OF FIBERS TO FACIAL NUCLEI) – 70-80% CHANCE THAT LESION IS IN DOMINANT HEMISPHERE, IF IN CEREBRAL CORTEX. POSSIBLE RELATION TO EARLIER CLUMSINESS (3).

11) NORMAL TEMP., & WBC COUNT, + DIFFERENTIAL – NO INDICATION OF INFECTION

12) FBS – 116 MG./100 CC. – SLIGHTLY ELEVATED ?

13) SELLA TURCICA INTACT – (RELEVANT TO (2)) – NO INDICATION OF PITUITARY INVOLVEMENT

14) CLINOID PROCESSES INTACT – NO INDICATION OF EROSION, WHICH MIGHT HAVE SUGGESTED LONG-STANDING INCREASE IN INTRA-CRANIAL PRESSURE.

15) NORMAL CSF PRESSURE – ALONG WITH (R), NO INDICATION OF ↑ INTRA-CRANIAL PRESSURE

16) COLORLESS SPINAL FLUID – NO EVIDENCE OF SUB ARACHNOID BLEEDING

17) WASSERMAN TEST NEGATIVE – PROBABLY NO NEURO SYPHILIS

18) PATIENT RAPIDLY BECAME ASYMPTOMATIC – INTERMITTENT RECURRENCES, WITH REMISSIONS, GETTING CLOSER TOGETHER – SUGGESTS SUCH ENTITIES AS MULTIPLE SCLEROSIS, VASCULAR PROBLEMS (AS),

SECOND ADMISSION – REPEAT OF SOME SX – ALL SUGGESTIVE OF GENERALIZED INCREASE IN INTRACRANIAL PRESSURE – YET, NO FUNDOSCOPIC OR SPINAL CSF EVIDENCE FOR ↑ INTRA-CRANIAL PRESSURE.

19) SLIGHT PTOSIS OF (R) UPPER EYELID – IN ABSENCE OF OTHER THIRD NERVE FINDINGS, POSSIBLY A TRANSIENT WEAKNESS ASSOCIATED WITH (L) UPPER MOTOR NEURON DISEASE (NOW ALSO SLIGHT WEAKNESS OF (R) ARM, POSSIBLY ↓ IN (R) SUPERFICIAL REFLEXES

20) POOR CONVERGENCE ?

21) ↑ BLOOD PRESSURE – ALSO DURING FOURTH ADMISSION

22) FEW RBC's + ↑ PROTEIN IN CSF – SECONDARY TO CEREBRAL VASCULAR HEMORRHAGE ?– UNLIKELY – NO XANTHOCHROMIA

23) EEG – SLOW WAVE ACTIVITY IN LEFT FRONTAL + PARIETAL REGIONS – A DESTRUCTIVE LESION HERE WOULD BE CONSISTENT WITH THE SIDE OF THE MOTOR FINDINGS (10, 19)

24) GRADUALLY CLEARED UP (SEE 18), <u>BUT</u> RESIDUAL PTOSIS (R), WEAKNESS IN (R) FACIAL MUSCLES (LOWER), AND EXTENSOR RESPONSE IN (R) FOOT COMBINED WITH EEG FINDINGS (23), IF LESION IS VASCULAR, SUGGESTS

KEY

INVOLVEMENT OF CORTICAL BRANCHES RATHER THAN OR IN ADDITION TO GANGLIONIC BRANCHES. ISCHEMIA IN STEM OF (L) ANTERIOR CEREBRAL ARTERY, WHICH ALSO FED (R) ANT. CEREBRAL HEAVILY. ~~SAW~~ ALSO, INVOLVEMENT OF (L) MIDDLE CEREBRAL ARTERY, WITH SPARING (RECOVERY) IN WATERSHED AREA BETWEEN ANT. + MIDDLE CEREBRAL ARTERIES.

THIRD ADMISSION (FOR RE-EVALUATION) + FOURTH ADMISSIONS

25) OCCIPITAL HEADACHES RECURRING, AT NIGHT OR IN EARLY MORNING — SUGGESTS ORGANIC CAUSE, INFRA-TENTORIAL.

26) UNSTEADY GAIT (3?) WITH DEVIATION TO THE (R) — POSSIBLY (WITH 25) INDICATES A VESTIBULAR OR (R) CEREBELLAR PROBLEM.

27) URINARY URGENCY WITH OCCASIONAL INCONTINENCE — DESCENDING AUTONOMIC CONTROL?

28) SUDDEN ~~VOMIT~~ EMESIS AND URINARY INCONTINENCE (27) — SUDDEN ↑ IN INTRA-CRANIAL PRESSURE.

29) COMATOSE, BUT PUPILS NORMAL SIZE + REACTIVE — NO UNCAL HERNIATION.

30) ORBICULARIS OCULI FLACCID BILATERALLY — I.E., UPPER FACE — EITHER BILATERAL UMN PROBLEM OR BOTH FACIAL NUCLEI (IN MID-PONS) INVOLVED.

31) SUPPLE NECK — NO DEMONSTRABLE MENINGEAL IRRITATION

32) BILATERAL EXTENSOR RESPONSE IN FEET — ALSO (SEE 30), SUGGESTS BILATERAL UMN PROBLEM.

33) DECALCIFICATION OF POST. CLINOIDS — EVIDENCE FOR LONG-TERM ↑ INTRACRANIAL PRESSURE OR LOCALIZED SOURCE OF PRESSURE.

34) ARTERIOGRAM (L) —) INCOMPLETE FILLING OF (L) ANT. CEREBRAL + DOWNWARD DISPLACEMENT OF (L) MIDDLE CEREBRAL. CONSISTENT WITH DISCUSSION IN (24) AND SUGGESTS EXTERNAL (I.E., NON-VASCULAR) ETIOLOGY — NEOPLASM?

SUDDENNESS OF BOTH ICTS + GENERAL NATURE OF MANY SX'S SUGGESTS INTERMITTENT BLOCKAGE OF CSF FLOW, WITH CONSEQUENT ↑ INTRA-CRANIAL PRESSURE.

I.E., MASS IN AREA OF STEM OF (L) ANT. + MIDDLE CEREBRAL ARTERIES — NEAR (L) FORAMEN OF MONRO. ABSENCE OF CALCIFICATION — POSSIBLY NOT A MENINGIOMA. LARGE ~~GLIOMA~~ EPENDYMOMA, CYST, ASTROCYTOMA?

APPENDIX THREE

SUMMARY OF APPROACHES FOR ESTABLISHING PRIORITIES AMONG MAINTENANCE OBJECTIVES

COMPARISON OF COMMON STRATEGIES FOR DETERMINING INSTRUCTIONAL OBJECTIVES

	TIME/EFFORT INVESTMENT	COMPREHENSIVENESS OF COVERAGE	VARIETY OF INPUT	SUBJECTIVITY OF METHOD	IDENTIFICATION OF ESSENTIAL COMPETENCIES	COMPLIANCE BY RATERS	COST
OPINION BASED							
Consensus of Experts	Fairly large investment of time/ effort. Usually involves a number of group meetings.	Fairly comprehensive in coverage- due to background of those involved. May underrepresent elementary skills.	Input mainly from specialists/ experts. Opinions from other fields, students, etc. usually not included.	A subjective method-based on opinions and experiences of experts.	Tends to focus on specialized skills. Underrepresents elementary skills.	High return as experts are normally brought in to the institution as paid consultants.	Fairly high due to consultant fees. More reasonable when local staff are used.
Survey/ Questionnaire	Limited time and effort on part of those completing it. More time and effort needed in preparation of survey.	Provides fairly comprehensive coverage depending on steps taken and personnel involved in development.	Can gather variety of input, including students, representatives of other fields, etc.	Subjective method. Draws information from variety of sources which may help to overcome rater biases.	Since survey questionnaires are dependent upon memory of respondents they are subject to selective forgetting and overemphasis. Careful design of questionnaire minimizes these problems.	Fairly high return, even when mailed, as investment of time and effort is low.	Fairly low as major investment is in questionnaire design.
Q Sort	Requires more time and effort on part of rater than does a survey/questionnaire. Requires less time and effort than the consensus of of experts approach typically does. As with other opinion based procedures requires less time & effort than observation based procedures, since rater responds to prepared statements.	Can provide fairly complete coverage if sample to be rated is complete. Dependent on personnel involved in development.	Capable of providing for variety of input, including students representatives of other fields, etc.	Is a rather subjective method based on opinions of those rating. However, variety of input may help to overcome rater biases. Q Sort has one advantage over other opinion based procedures; it does not allow raters to assign the same rating to all competencies. Raters are required to place some competencies in every rating category thus insuring differential weightings.	Dependent upon completeness and comprehensiveness of material presented to rater.	Generally, compliance is high since it requires relatively small investment of time and effort.	Relatively small cost compared to other methods since major investment is in preparation of Q Sort material.

	TIME/EFFORT INVESTMENT	COMPREHENSIVENESS OF COVERAGE	VARIETY OF INPUT	SUBJECTIVITY OF METHOD	IDENTIFICATION OF ESSENTIAL COMPETENCIES	COMPLIANCE BY RATERS	COST
OBSERVATION BASED							
Task Analysis	Large amount of time/effort needed due to detail involved.	Defines and describes activities performed daily by physicians. Comprehensiveness dependent of sampling a large number of physicians.	Usually input from experts-and/or observers trained in task analysis.	Represents an objective method in that it is based on tasks performed daily by physicians.	Results in identification of essential competencies if a representative sample of physicians is observed.	High return as individuals are normally paid for collecting the data.	Expensive. Requires highly paid trained observers for long periods of time.
Critical Incident	Large amount of time/effort investment. Observers-respondents required to describe cirtical incidents.	Tends to overlook less common activities-competencies of physicians. Unrealistic for use in defining total scope of physician activities.	Input is generally from experts in a field. One study used input of students, patients, etc. Different competencies were identified by the different subgroups.	Relatively objective. Dependent on many competent observers-reporters of the incidents and completeness of reports.	Effectively identifies many competency areas though some elementary, essential competencies may be overlooked.	Low. One study which used a mailed critical incident procedure had a 23% return with systematic follow-ups. Return would be low even with personal contact as the technique requires a carefully prepared original response.	Relatively expensive. Requires highly paid specialists to identify critical incidents.
Direct/ Indirect Observation	Usually represents much time/ effort in direct observation. Less time/effort for indirect observation.	Dependent on length of observation, clear specification of dimensions to be observed, and sampling a large number of physicians. Also dependent on training of people doing the observation.	Input from specialists - primarily, trained observers.	Dependent upon careful planning of dimensions to be observed.	Dependent upon careful planning of dimensions to be observed and a representative sampling of physicians. Typically less effective than task analysis or critical incident.	High return as individuals are normally paid for collecting the data.	Expensive. Requires highly paid trained observers for long periods of time.

APPENDIX FOUR

COVER LETTER AND RATING FORM

Southern Illinois University
School of Medicine
P.O. Box 3926
Springfield, Illinois 62708

TO: SIU School of Medicine Students, Residents and Faculty

FROM: D. Dax Taylor, M.D.
Associate Dean for Medical Education

SUBJECT: Development of Sequence I Comprehensive Examination

As many of you know, the Policy Advisory Committee of the SIU School of Medicine endorsed development of a system of internally constructed comprehensive examinations for use in the undergraduate medical education program at SIU. This decision was made for two related reasons. First, the potential value of comprehensive examinations is as much instructional as evaluational. Such examinations when properly designed not only cause students to review material learned earlier but also encourage integration and application of major concepts, strategies and skills.

Second, the National Board Examinations, which serve as comprehensive examinations for some schools who give comprehensives, sacrifice measurement of students' abilities to integrate and apply information and concepts for the convenience of developing an examination which can easily be machine scored. Eighty percent of the items on the National Board Examinations require only recall of facts by the student. Such an examination when used for our purposes is self-defeating, as it primarily stimulates student rehearsal of detailed material learned at the module level rather than integration of material from a number of areas and disciplines, and application of the major concepts learned in this process.

Of course, the comprehensive examinations we produce will have the same weaknesses if we are not careful in all stages of their development. The initial stages of development are extremely important. For that reason, a number of faculty have been working throughout the year designing a strategy for examination development which will insure that a.) the objectives tested will represent important competencies, b.) the examinations will require integration and application, c.) the examinations will be consistent with the educational philosophy of the school, and d.) will be an effective learning experience for students.

Work on development of the strategy has been completed and the strategy is being used by the Carbondale Sequence I faculty in constructing a pilot comprehensive examination for Sequence I. In July (1976) efforts will be turned to development of comprehensive examinations for Sequence II. Sequence III examinations will be developed during the following year (starting July 1977).

Meanwhile, we need your assistance in developing the comprehensive examinations for Sequence I. In order to insure that the comprehensive examinations measure predominantly critically important learning outcomes we are asking people with varying perspectives (students, residents, basic science and clinical faculty) to read objectives from Sequence I modules and to provide judgments regarding the importance for students to retain each competency to the completion of Sequence I. The objectives rated as critically important will serve as the basis for constructing the examinations. We would appreciate your cooperation in this matter.

Enclosed you will find: a) a set of instructions for rating objectives; b) a number of modules from Sequence I and a separate Optical Scanning Answer Sheet for each module (attached to the module); c) a pre-addressed campus mail envelope. For each module kindly read the objectives for the module, rate each objective according to the instructions enclosed and then mail the answer sheets to Dr. Reed Williams, using the pre-addressed envelope.

This task will take some time on your part but it will make the difference between a token comprehensive examination program and one which has both instructional and evaluational benefits for future students and faculty. Please return the answer sheets promptly. Since there are so many objectives and so few faculty, your input is essential to insure representative judgments about the importance for retention of these objectives.

Thanks for your cooperation.

Instructions for Rating Objectives in All Modules

This questionnaire is for recording your judgments regarding the competencies (knowledge and skills) learned in Sequence I which should be retained by students. The responses you provide will be used in deciding what competencies from Sequence I should be strengthened through built-in review activities. Likewise, your responses will be used in constructing appropriate end-of-sequence comprehensive examinations for Sequence I.

Enclosed you will find a number of modules from Sequence I with a separate Optical Scanning form attached for each module. Use the attached Optical Scanning form for that module only. For each objective in the module (designated by arabic numbers), please read the objective and then select the description below which most accurately represents your judgment about end-of-sequence retention of the competency described in the objective:

A---Retention of this competency in its originally learned form and detail is essential for the duration of Sequence I.

B---Retention of this competency in its originally learned form and detail is highly desirable but only retention of the main idea is essential for the duration of Sequence I.

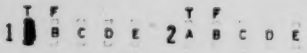
C---Retention of the main idea is desirable but not essential.

D---Important only to recall existence and to be able to look up when needed.

E---This objective is inappropriate for undergraduate medical education.

Blank---Leave the item blank if you have absolutely no understanding of the terminology or the concept and therefore have no basis for judgment.

For example, if after reading the first objective in a particular module, you believe that the competency represented should be retained in its originally learned form and detail for the duration of Sequence I, you would mark the answer sheet for that module as follows:



It is not necessary to put any marks on the answer sheets other than the ratings. When you have rated all the objectives for that module, set the answer sheet for that module aside. Rate the objectives for the second module on its respective answer sheet.

An individual's response to the objectives in a module will vary according to his experience and area of specialization. Please answer this questionnaire from your own point of view at the present time.

Your cooperation in carefully and promptly completing the answer sheets and returning them in the enclosed, pre-addressed campus mail envelopes will be appreciated. Please return no later than

Due to variations in module format you may occasionally have questions about what you are to rate. If so, or if you have other questions, please call Bob Colvin or Roger Robinson in Carbondale (536-5511) or Janet McDole, John Shatzer, or Reed Williams in Springfield (782-2440).

APPENDIX FIVE

EXAMPLE OBJECTIVES RATINGS PRINTOUT PLUS INSTRUCTIONS

BLOCK 9 PROBLEM UNIT 2 MODULE 3

MODULE TITLE: MORPHOLOGY OF THE UTERUS

RATER	RATER STATUS	SEQUENCE	BASE	SPECIALTY	OBJ 2	OBJ 3	OBJ 4	OBJ 5	OBJ 6
73	4	3	S	HEMATOLOGY, PEDIATRIC	D	D	D	D	C
92	1	1	C	ENDOCRINOLOGY	A	A	A	B	A
85	2	1	C	ANATOMY, GENERAL	B	B	A	B	B
81	4	3	S	FAMILY PRACTICE	B	B	B	C	B
109	5	2	S	STUDENT	B	C	C	C	B
112	6	*	S	FAMILY PRACTICE	A	B	A	A	A
				MEAN RATINGS	3.0	2.7	3.0	2.5	3.2

BLOCK 9 PROBLEM UNIT 2 MODULE 5

MODULE TITLE: CONTROL OF OOGENESIS, OVULATION AND CORPUS LUTEUM FORMATION

RATER	RATER STATUS	SEQUENCE	BASE	SPECIALTY	OBJ 2	OBJ 4	OBJ 8	OBJ 9
47	2	1	C	ENDOCRINOLOGY	C	B	B	B
92	1	1	C	ENDOCRINOLOGY	A	B	B	A
88	4	3	S	INTERNAL MEDICINE, GENERAL	B	C	C	B
325	5	3	S	STUDENT	B	A	A	B
326	5	3	S	STUDENT	B	B	B	B
				MEAN RATINGS	3.0	3.0	3.0	3.2

BLOCK 9 PROBLEM UNIT 2 MODULE 6

MODULE TITLE: GONADOTROPINS AND STEROIDS IN THE FEMALE

RATER	RATER STATUS	SEQUENCE	BASE	SPECIALTY	OBJ 1	OBJ 4	OBJ 5	OBJ 7	OBJ 10
47	2	1	C	ENDOCRINOLOGY	D	B	B	B	B
92	1	1	C	ENDOCRINOLOGY	A	B	B	C	A
132	4	3	S	PSYCHIATRY, GENERAL	C	B	C	B	C
328	5	3	S	STUDENT	B	B	B	A	B
				MEAN RATINGS	2.5	3.0	2.8	3.0	3.0

OR **** NOT APPLICABLE

Ratings of Curricular Objectives
Guidelines for Interpreting Reports

The following information will aid you in interpreting the data in the accompanying computer printouts. The final ratings of each objective from your respective block are tallied and summarized in four different reports.

Ratings from two basic science faculty, two faculty clinicians, two advanced standing students (Sequences II and III) and two residents provide a variety of perspectives in rating the importance for maintenance of each objective. Ideally, then, there will be eight ratings for each module objective, but the actual number will vary according to returns. Information on rater characteristics are given in addition to individual objective ratings.

Listed below are some guidelines which will assist you in decoding the numerical symbols on the printout and interpreting the information provided.

1. Rater Information Codes.

   1.1 Rater status - describes the person rating a particular module in terms of his/her relationship to that module.

   1 - module author
   2 - non-author, member of organ system team
   3 - other faculty (basic science)
   4 - other faculty (clinical)
   5 - student
   6 - resident

   1.2 Sequence - refers to sequence the rater is primarily associated with.

   1 - Sequence I
   2 - Sequence II
   3 - Sequence III
   4 - Sequence IV
   * - unavailable or irrelevant (applies mostly to residents)

   1.3 Specialty - simply gives a brief description of the rater's perspective by specialty.

2. Objectives Rating Information

   2.1 The description of the individual letter ratings are as follows:

   A - Retention of this competency in its originally learned form and detail is <u>essential</u> for the duration of Sequence I.

   B - Retention of this competency in its originally learned form and detail is highly desirable but only <u>retention of the main idea is essential</u> for the duration of Sequence I.

C - Retention of the main idea is desirable but not essential.

D - Important only to recall existence and to be able to look up when needed.

E - This objective is inappropriate for undergraduate medical education.

Blank - Printed as 'F' and means rater had absolutely no understanding of the terminology or the concept and therefore had no basis for judgment.

2.2 Individual ratings for objectives have been recorded on the printout in the order they were received. The ratings for a given objective were then converted to numerical values and averaged to obtain the mean rating by all raters.

A = 4
B = 3
C = 2
D = 1
E = 0
F = not averaged

An easy way to conceptualize these averages is to view the mean rating like a grade point average (GPA) and the individual ratings like separate grades for courses.

3. Reports Provided

The accompanying four reports (computer printouts) provide the following information:

Report 1: List of ratings for objectives rated as "essential that students demonstrate competency in originally learned form and detail" ($\bar{x}$ = 3.3 or above with A = 4 and E = 0).

Report 2: List of ratings for objectives rated as "essential that students demonstrate retention of the main idea" ($\bar{x}$ = 2.5 - 3.2).

Report 3: List of ratings for objectives rated as "inappropriate for undergraduate medical education" ($\bar{x}$ = 0 - .5).

Report 4: List of ratings for all objectives and their respective mean ratings.

APPENDIX SIX

TAXONOMY OF OBJECTIVES

OPERATION	CONTENT	TEST MODE: RECOGNITION	TEST MODE: PRODUCTION	EXAMPLE OBJECTIVES [RECOGNITION = (1)] [PRODUCTION = (2)]
Memorization	Factual Information	Given a cue and a set of alternatives, select the exact replica of information previously learned.	Given a cue, construct an exact replica of information previously learned.	Given the previously studied diagram of body compartments and a list of words identifying each compartment, label each compartment with the appropriate identifying word. (1) Given a previously seen diagram of body compartments, label each body compartment. (2) OTHER EXAMPLES: Recalling normal values (e.g. blood pressure, temperature). Recalling services offered by particular hospitals. Recalling definitions for medical terms.
Summarization	Facts, concepts, principles, procedures.	1. Given a paraphrase description, select the correct name for the fact, concept, principle or procedure. 2. Given the name, select the correct paraphrased description of a fact, concept, principle or procedure.	1. Given a paraphrase description, write the correct name for the fact, concept, principle or procedure. 2. Given the name, write a paraphrased description of the defining attributes of the fact, concept, principle or procedure.	Describe in writing the rotation of the gut. Include in your description the concept of a tube within a tube, that is, the alimentary tract within the body tube showing the mesenteries. (2) Given paraphrase description of optical measurement instruments, select from a list the correct name of each instrument. (1)
Instantiation	Concepts, principles, procedures.	1. Given the name, select a previously unused example of the concept, principle or procedure(?). 2. Given a previously unused example of the concept, principle or procedure, (?), select the correct name.	1. Given the name, create a previously unused example of the concept, principle or procedure(?). 2. Given a previously unused example of the concept, principle or procedure, (?), name it.	On any female cadaver, locate the following: a. Arteries 1. Vaginal 2. Inferior epigastric 3. Internal pudendal 4. Inferior rectal 5. Uterine 6. Ovarian b. Veins 1. Corresponding veins to the arteries listed above. (1)

OPERATION	CONTENT	TEST MODE: RECOGNITION	TEST MODE: PRODUCTION	EXAMPLE OBJECTIVES [RECOGNITION = (1)] [PRODUCTION = (2)]
Instantiation (cont'd)				Give an example, not provided during instruction, of each of the antagonisms listed below: chemical antagonism physiological antagonism pharmacological antagonism non-competitive (non-specific) antagonism (2)
Prediction	Concepts	Given some of the defining chacteristics of an object, select other expected characteristics from a list.	Given some of the defining chacteristics of an object, list other expected characteristics.	Given a case history and physical exam findings, predict what findings you would expect on a radiograph. (2)
	Principles	Given a previously unused description of a situation with the antecedent conditions for a relationship embedded, select from alternatives the most likely consequences.	Given a previously unused description of a situation with the antecedent conditions for a relationship embedded, describe the most likely consequences.	Given a medical sign or symptom, the student will describe all sites where a lesion might exist that would cause that sign or symptom and will give a sound physiological explanation as to how a lesion in each site could cause the resultant symptom. (1)
	Procedures	Given a previously unused description of a situation in which a procedure is applied, select from alternatives the most likely outcome.	Given a previously unused description of a situation in which a procedure is applied, describe the most likely outcome.	Given the description of a hypotensive patient, predict the actions of therapeutic doses of norepinephrine on cardiac output. (2)
Application	Concepts	Same as Instantiation.	Same as Instantiation.	

OPERATION	CONTENT	TEST MODE: RECOGNITION	TEST MODE: PRODUCTION	EXAMPLE OBJECTIVES /RECOGNITION = (1)/ /PRODUCTION = (2)/
Application (cont'd)	Principles	Given a previously unused case and a desired outcome, select the set of antecedent conditions necessary to achieve that outcome.	Given a previously unused case and a desired outcome, arrange the antecedent conditions necessary to achieve that outcome. (Less preferred alternative: describe the antecedent conditions necessary to achieve that outcome)	Given a patient exposed to cryptococcosis as the compromised host, list possible steps that could be taken at the present time to protect the patient from acquiring cryptococcal meningitis. (2)
	Procedures	Given a previously unused case and a desired outcome, select the set of procedures necessary to achieve that outcome.	Given a previously unused case and a desired outcome, apply the procedures necessary to achieve that outcome. (Less preferred alternative: describe the steps in using procedures necessary to achieve that outcome)	Given any patient symptom, describe the procedure necessary to determine if the symptom is an adverse reaction due to drug-drug interaction rather than a disease manisfestation. (2)
Evaluation	Principle-Procedure	Given a description of a situation, a list of alternative actions and the criteria to be used, select the most desirable action.	Given a description of a situation, a list of alternative actions and the criteria to be used, describe which action is most desirable.	

OPERATION	CONTENT	TEST MODE: RECOGNITION	TEST MODE: PRODUCTION	EXAMPLE OBJECTIVES	[RECOGNITION = (1)] [PRODUCTION = (2)]
Evaluation	Principle-Procedure	Same as above.	Given a description of a situation and a list of alternative actions, describe which action is most desirable and the criteria on which your decision was based.		
	Principle-Procedure	Same as above.	Given a description of a situation, list the alternative actions available, describe the most desirable action and describe the criteria on which your decision was based.	You want to measure the level of a constituent (x) of cerebrospinal fluid and have decided that a spectrophotometer is the instrument of choice in this particular case. You must carefully select a technique to make a quantitative measurement. a) List possible experimental techniques that you could attempt to resolve the problem. b) describe the most appropriate technique, and describe the criteria on which your decision was based. (2)	

APPENDIX SEVEN

EVOLUTION OF RENAL CUMULATIVE OBJECTIVES

First draft by Block Coordinator after a 1 day discussion/ planning session.

CUMULATIVE GOALS
RENAL BLOCK

1. Describe suitable procedures for measuring the rates of renal plasma flow and glomerular filtration and outline the mechanism by which these parameters vary in response to changes in blood pressure, renal arteriolar tone, plasma oncotic pressure, tubular pressure and the structural changes which occur in the glomerulus in glomerulonephritis.

2. Given a case presentation which includes values for BUN and creatinine, interpret the clinical significance of those values in terms of diet, body weight, glomerular filtration rate and the rate of urine production.

3. Describe how the handling of the following substances by the healthy kidney is disrupted during the specified disease process:

   a. Glucose in diabetes and renal glycosuria.
   b. Calcium and phosphate in chronic renal failure.
   c. Amino acids in various aminoacidurias.
   d. Uric acid in cytolytic disease, gout and uric acid lithiasis.
   e. Protein in glomerular disease and orthostatic and idiopathic proteinuria.

4. Describe how the body's content concentration and distribution of sodium and water are regulated by ariations in dietary intake, the infusion of NaCl solutions of various concentrations and in response to the disruptions caused by acute and chronic renal failure, edema, and the pathological changes in the reninangiotensin-aldosterone axis and the administration of diuretics.

5. Given a case presentation which includes values for pH, HCo_3, pCo_2, total Co_2 or any two of these, define the condition in terms of simple/mixed, metabolic/ respiratory, acidosis/alkalosis and compensated/uncompensated and suggest appropriate causes. Predict and explain the responses of the body buffers, the lung, the kidneys and the body's content and distribution of $K+$ during compensation or in response to therapy.

6. Describe how congenital abnormalities, neurological lesions and obstructions at the following sites in the urinary tract alter the normal mechanisms of urinary flow and micturition and interfere with the defenses of the tract against infection.

Rewrite by grant personnel.

Cumulative Objectives
Renal Block
Sequence I
October, 1976

1. Given a case with a diagnosis or information necessary to determine a diagnosis, including data necessary to calculate or estimate glomerular filtration rate, the student will:

   a. calculate or estimate GFR.
   b. identify GFR as normal, elevated or depressed.
   c. list all possible combinations of directional changes in BP, renal arteriolar tone, plasma oncotic pressure, tubular hydrostatic pressure, tubular osmotic pressure, filtration area and permeability which could produce this ΔGFR or an unexpected failure to change.

2. Describe suitable procedures for measuring rates of renal plasma flow and GFR in humans. Explain why this process is not normally used.

3. The student will identify the range of blood pressure values not resulting in appreciable changes in renal plasma flow and will explain the mechanism which maintains renal plasma flow at the same rate in spite of blood pressure changes.

4. Given a case presentation which includes values for BUN and creatinine the student will describe expected findings in terms of each of the following:

   a. diet.
   b. body weight.
   c. glomerular filtration rate.
   d. rate of urine production.

5. Given abnormal values for the following substances, select from a list of specified diseases those which could produce the abnormal values and explain the changes in kidney functioning which are responsible for those abnormal values in those diseases.

Substances	Diseases
glucose	diabetes
calcium and phosphate	renal glycosuria
amino acids	chronic renal failure
uric acid	various aminoacidurias
protein	cytolytic disease
	gout
	uric acid lithiasis
	glomerular disease
	orthostatic and idiopathic proteinuria

6. Given a disease from the attached list, the student will:

   a. select from a list of substances those which would present as abnormal values in that disease.
   b. indicate whether each value would be high or low.
   c. explain the changes in kidney functioning which are responsible for the abnormal findings.

Substances	Diseases
glucose	diabetes
calcium and phosphate	renal glycosuria
amino acids	chronic renal failure
uric acid	various aminoacidurias
protein	cytolytic disease
	gout
	uric acid lithiasis
	glomerular disease
	orthostatic and idiopathic proteinuria

7. Given specific variations in one or more of the following conditions:

   1) dietary intake
   2) infusion of NaCl concentrations
   3) disruptions caused by:
      acute renal failure
      chronic renal failure
      edema
      pathological changes in the reninangiotensin-aldosterone axis
      administration of diuretics
      alterations in the ultrastructure of the glomerulus

   a. describe expected changes in concentration of sodium and water in each of the following body spaces:

      1. intracellular
      2. interstitial
      3. vascular

   b. describe the process by which the body's content concentration and distribution of sodium and water are regulated directly or indirectly in response to these variations.

8. Given a case presentation which includes values for pH, HCO_3, PCO_2, total CO_2, or any two of these, the student will:

   a. define the condition in terms of simple/mixed, metabolic/respiratory, acidosis/alkolosis, compensated/uncompensated.
   b. identify causes that might produce these values based on information presented in the case.
   c. predict and explain the responses of the body buffers, the lung, the kidneys, and the body's content and distribution of K^+ during compensation or in response to therapy.

9. Given a case presentation where congenital abnormalities, neurological lesions and/or obstructions to the urinary tract are present, or information necessary to deduce the abnormality, lesion or obstruction, the student will describe how these conditions:

   a. alter normal mechanisms of urinary tract flow and mieturition.
   b. interfere with the defenses of the tract against infection.

APPENDIX EIGHT

REPORT ON REVIEW OF CUMULATIVE OBJECTIVES

BY DONALD A. BOSSHART

10/21/76

TO: Reed Williams

FROM: Don Bosshart, Associate Director
Office of Research in Medical Education
University of Texas Medical Branch at Galveston

Donald B. Bosshart

RE: Review of Cumulative Objectives - General Comments & Reactions

There appears to be a fair difference in the extent that the different blocks were able to pull out "important" competencies. These differences may have a significant effect in the relative weight that each block is given on the exam. This is a problem that will need to be addressed -- e.g. the "harder" the cumulative objective the more student time and energy spent reaching the objective -- perhaps at the expense of other objectives which are actually of more importance to the practice of medicine.

I was impressed by the degree of clinical relevance of most of the competencies. Is it "fair" to expect students to reach these objectives, considering the nature of the modules as they presently exist? The first comprehensive exam may be primarily program evaluation in nature since some of the objectives may not be adequately linked in the sense of logic to the actual instruction.

A major problem with many of the objectives is that they do not contain specific criteria for judging "adequate" or "acceptable" performance. This is partly due to the fact that the performance required is usually a written brief essay response. The elements of the "acceptable" response need to be specified in the objective.

The second reason that criteria for acceptable performance is not clear is the fact that many of the objectives are not clear enough to enable a test writer to reliably generate test items. I favor objectives that deliniate a domain of test items -- key elements or dimensions of the domain need specification. This process of deliniating test item domains takes time and a clear conceptualization of what the actual set of test items will actually be like. Perhaps a strategy to use with faculty is to have them go to the item writing phase and then go back to revise the objective so that key dimensions of the items can be included.

In constructing the exam I think it is important that students not be "cued" by the item to the instructional material. If, for example, a clinical case is presented and it may be possible to weave in neurosciences, medical humanities and medical sociology. Students need to be able to "see" the relevance of medical sociology concepts (religious beliefs, culture) to a medical problem without telling them that they are supposed to look for the concepts. Some creative thinking and interdisciplinary work will need to be done to design items or contexts in which multiple objectives can be assessed and then respective performance data "pulled out" for feedback to the respective departments. This process of developing the test may prove to be an exciting ground for the medical sociologist, for example, to interact with the clinical faculty.

THE UNIVERSITY OF TEXAS MEDICAL BRANCH
GALVESTON, TEXAS 77550

Office of the Dean of Medicine
3 November 1976

Reed Williams, Ph.D.
Department of Medical Education
Southern Illinois University
School of Medicine
Springfield, IL

Dear Reed:

I enjoyed my visit to Carbondale and would like to express my excitement with the progress you have been making in establishing cumulative objectives. After reviewing all the drafts of cumulative objectives for Sequence - I and making specific recommendations about how a number of these objectives could be clarified, I must congratulate you with the general quality of the product of your efforts.

In my memo of October 21, 1976, I expressed a number of concerns about the project. After some additional thought, it occurred to me that perhaps you may consider the possibility of getting interdisciplinary teams to revise the objectives still further. In this way, putting the objectives into examination formats that do not "cue" the student about subject matter can be facilitated. This will become more important in dealing with the clinical disciplines.

Yours very truly,

Donald A. Bosshart

Donald A. Bosshart, Ed.D.
Associate Director, Office of
Research in Medical Education

APPENDIX NINE

CUMULATIVE OBJECTIVES

Cumulative Objectives
Neuroscience
Sequence I
October, 1976

1. Describe the biophysical mechanisms underlying the establishment of the resting membrane potential and mechanisms for the action, receptor and generator potentials.

2. Describe the process of neurotransmission incorporating the concepts underlying the following:

   a. Anatomy of the synapse
   b. Synthesis, release and degradation of the major neurotransmitters (e.g., acetylcholine, norepinephrine, etc.)
   c. Excitatory and inhibitory post-synaptic potentials, presynaptic inhibition and facilitation
   d. Drug action as related to a, b, and c above.

3. List the representative types of drugs which affect consciousness and describe the routes of administration and factors affecting rate of absorption.

4. For the special senses of taste, hearing, vision and equilibrium:

   a. Given radiographs, photomicrographs, models, photographs, drawings or preserved specimens, identify major anatomical structures.
   b. Describe the basic physiologic mechanisms underlying the function of each of the senses above.

5. Describe the functional anatomy (including basic physiology and pharmacology) of the autonomic nervous system including its major subdivisions (parasympathetic/sympathetic), adrenergic/cholinergic receptor sites and mechanisms of drug action.

6. For the tendon jerk, clasp knife, crossed extensor and flexion reflexes describe pathways and synaptic mechanisms involved including the processes of facilitation, inhibition (pre & post synaptic) and synaptic transmission.

7. Describe the embryological events which lead to the formation of each of the following:

   a. The three primary brain vesicles and their subsequent transformation to the five secondary brain vesicles
   b. The myelin sheath around axons in the fetus
   c. The brain flexures
   d. The eye
   e. The internal, middle and external ear
   f. The cauda equina
   g. The hypophysis
   h. The peripheral nervous system (cranial, spinal and autonomic)

8. When presented with a list of "injuries" to non-CNS areas in the head and/or neck region (including names of non-pathway structures damaged), name the cranial nerves nearby that might also be included in the damaged area.

9. When presented with an X-ray taken during the arterial phase of a carotid and/or vertebral arteriogram, identify the view, describe briefly each designated point on a supratentorial artery (e.g., proximal portion of middle cerebral artery or point where internal carotid divides into anterior and middle cerebral arteries), list the abnormal neurologic findings one might expect to find if blockage (e.g., due to thrombosis or embolism) or hemorrhage occurred at that point, and explain the anatomical basis for the abnormal findings.

10. When presented with a list of single or multiple symptoms or signs involving states of consciousness and/or the head (and neck) region, name the potential locations at which damage might cause the findings, naming specific neural structures whenever possible and designating side on which the structure occurs in all cases. For each structure named, give additional findings you might look for if the damage were secondary to an expanding, localized lesion. Name the terminal blood supply as specifically as possible, and give additional findings you might look for if the damage were secondary to a vascular, localized lesion. For cortical structures, include Brodmann areas. For each set of one or more findings (as presented), rank the alternatives in terms of deceasing likelihood as best you can.

11. When presented with a list of descriptions of sites of lesions in the CNS (which may include diagrams, verbal descriptions or presentation of radiographic studies), list the motor abnormalities expected (if any) for each site and state briefly the anatomic basis for each abnormality.

12. When presented with a list of single or multiple neurologic symptoms or signs, name the potential locations at which damage might cause the findings, naming specific neural structures whenever possible and designating side on which the structure occurs in all cases. For each structure named, give additional findings you might look for if the damage were secondary to an expanding localized lesion. Name the terminal blood supply as specifically as possible and give additional findings you might look for if the damage were secondary to a vascular, localized lesion. For cortical structures, include Brodmann areas. For each set of one or more findings (as presented), rank the alternatives in terms of decreasing likelihood as best you can.

Cumulative Objectives
Locomotor Block
Sequence I
November, 1976

All objectives must be performed at the following level: Identify by naming, orally or in writing and without references, a structure designated on a cadaver, living subject, skeleton, plastic model or X-ray, where appropriate, or by labelling diagrams which include the structure. In addition describe orally, or in writing, the structure and/or its function.

Objectives:

1. Describe how the following substances influence bone metabolism.

    a. minerals: calcium, phosphorus, sodium, hydroxyapatite.
    b. trace minerals: magnesium, fluoride.
    c. enzymes: alkaline phosphatase, acid phosphatase.
    d. hormones: calciferol, parathormone, thyrocalcitonin, androgen, estrogen, thyroxine.
    e. protein: colagen.
    f. others: ground substances.

2. Describe the changes in muscle glycogen concentration from rest, to early in exercise, during steady-state exercise and at exhaustion.

3. Describe in sequence (with diagrams or X-rays) the cellular events in the healing of a closed simple fracture, including an approximate time scale of the occurence of the stages.

4. Define the following terms:

    a. motor unit
    b. motor end plate
    c. motor neuron
    d. neuromuscular junction.

5. On a long bone sectioned longitudinally, on a radiograph or an unlabelled diagram, identify these structures:

    a. Cortical (dense, compact) bone
    b. Cancellous (trabecular, spongy) bone
    c. Trabeculae
    d. Medullary cavity (marrow space)
    e. Epiphysis
    f. Metaphysis
    g. Diaphysis
    h. Periosteum
    i. Endosteum
    j. Articular surface
    k. Epiphyseal plate
    l. Nutrient foramen

6. Identify the following structures of the parotid region and demonstrate by pointing out on a cadaver or labelling a previously unseen drawing.

   a. Parotid gland
   b. Parotid duct
   c. Facial nerve
   d. Pharynx
   e. Mastoid process
   f. Internal carotid a.
   g. Internal jugular v.
   h. Ramus of mandible
   i. Sternocleidomastoid m.
   j. Masseter m.
   k. Buccinator m.

7. Identify on a cadaver, plastic model or drawing the structures listed below:

   a. Orbital Region
      (1) Eyelids
      (2) Palpebral fissure
      (3) Conjunctiva
      (4) Eyelashes
      (5) Lacus lacrimalis
      (6) Caruncula lacrimalis
      (7) Lateral palpebral ligaments
      (8) Medial palpebral ligament
   b. Lacrimal Apparatus
      (1) Lacrimal gland
      (2) Lacrimal sac
   c. Orbit
      (1) Orbital margin
      (2) Muscles of orbit
         (a) Levator palpebrae superioris
         (b) Rectus (four)
         (c) Superior oblique
         (d) Inferior oblique
      (3) Nerves of orbit
         (a) Optic n.
         (b) Frontal n.
         (c) Trochlear n.
         (d) Oculomotor n.
         (e) Nasociliary n.
         (f) Abducent n.
      (4) Ophthalmic a.
      (5) Ophthalmic v.
   d. Ear
      (1) External ear
         (a) Auricle
         (b) External auditory meatus
      (2) Tympanic cavity - (no detailed description of walls)
         (a) Ossicles
            (i.) Maleus
            (ii.) Incus
            (iii.) Stapes

(b) Muscles
  (i.) Tensor tympani
  (ii.) Stapedius
(c) Auditory tube
(d) Mastoid antrum
(e) Mastoid air cells
(f) Facial nerve
(g) Vestibulocochlear nerve

8. Identify and explain the meaning of origin, belly, insertion.

9. Describe the anatomical location of the mammary glands and their lymphatic drainage. Describe the clinical significance of the drainage.

10. Describe the role of intervertebral discs with regard to motion of the back, also describe their structure and structural changes with age.

11. Locate the following muscles and discuss their function:

a. Trapezius
b. Latissimus dorsi
c. Levator scapulae
d. Rhomboideus major & minor
e. Deltoid
f. Serratus posterior superior & inferior
g. Supraspinatus & Infraspinatus
h. Terres major & minor
i. Pectoralis minor
j. Subscapularis
k. Scalenus anterior

12. Orally or in writing or by demonstration on a living subject define the terms listed below:

a. The anatomic position (all descriptions of location of structures and direction of movement are related to this position).
b. Planes
  (1) sagittal
  (2) mid-sagittal (median)
  (3) coronal (frontal)
  (4) transverse (cross-sectional, horizontal)

13. On a cadaver, delineate the surface projection of the course of the ischiadic (sciatic) nerve through the buttock. Explain the common clinical importance of knowing its position.

14. Point out on a cadaver and name the nerves to the shoulder area branching from the brachial plexus, demonstrating their relationships to the muscles of the area, with emphasis on the following:

a. Make a rough sketch of and be able to label the relative positions (as seen on a cadaver) of:
  (1) brachial, radial, and ulnar arteries
  (2) median, radial, and ulnar nerves
  (3) tendon of the biceps brachii
  (4) origin of brachioradialis

b. Indicate with diagrams the cutaneous areas and intrinsic muscles served by the radial, ulnar and median nerves, describing the cutaneous deficit which would result from loss of function of each.
c. On a prosected cadaver or with diagrams, demonstrate the course of the radial, ulnar, and median nerves through the forearm (and the site of easy injury to the median nerve). Demonstrate the course of the radial and ulnar arteries.
d. On a cadaver, on yourself, and on a partner, identify the brachial veins.

15. By superficial examination on five different persons identify the basilic, cephalic, and medial cubital veins, noting the variability in different individuals. Explain the common clinical uses of each vein.

16. Identify the femoral nerve, femoral artery, femoral vein, the adjacent lymph nodes, the femoral canal, and the boundaries of the femoral triangle. Explain the mnemonic acronym NAVEL. (Explain a mnemonic acronym).

17. Identify the boundaries of the popliteal fossa. Identify the following structures in the fossa and demonstrate their relative positions:

a. popliteal artery
b. tibial nerve
c. common peroneal nerve
d. sural nerve
e. popliteal vein
f. small saphenous vein

18. Demonstrate the palpable arterial pulsations in the foot and name the arteries.

19. By oral demonstration with an articulated skeleton, or by written description with diagrams, identify the following parts associated with the completely-formed joint:

a. articular cartilage
b. articular cavity
c. articular disc
d. articular capsule - fibrous and synovial layers
e. synovial fluid
f. external and internal ligaments
g. sesamoid bones (associated with some joints)

20. For the following joints:

a. The knee joint
   (1) identify on a cadaver the flexors and extensors of the leg.
   (2) demonstrate on a living person, describing orally the position of the patella on flexion and extension.
b. The hip joint
   (1) Name on a skeleton, the bones which comprise the joint specifying the type of hip joint.
   (2) Name the joint's principle ligament, describing where the ligament attaches, and explaining how it stabilizes the hip joint when tightened and how the tightening is released.
   (3) Identify the muscles producing the following actions at the hip joint, describing, orally or in writing, the actions: flexion, extension, adduction, abduction, lateral (external) rotation, medial (internal) rotation.

c. The ankle joint
   (1) Describe, orally on a living subject, cadaver or articulated skeleton, or in writing with the aid of diagrams or X-rays, the movements possible at the ankle joint, identifying the muscles producing these movements.
   (2) Describe the mechanical limitations of movement provided by: (a) the ankle mortise and wedge shape of the superior portion of the talus, (b) the ligaments of the joint and their relative strengths, and (c) the position of the tendons crossing the joint.

d. On a skeleton, name the bones that comprise the shoulder joint and point out the shallow depression (glenoid fossa) on the scapula that receives the head of the humerus.

e. Demonstrate the superficial and deep flexor (anterior compartment) and extensor (posterior compartment) groups of the wrist and hand.

21. Identify the following bones and their articulating surfaces, using a skeleton and X-rays:

a. humerous
b. radius and ulna
c. femur
d. tibia and fibula

Cumulative Objectives
Respiratory Organ System
Sequence I
October, 1976

1. Describe the following functions of the human lung:

   a. respiration and gas exchange.
   b. metabolic and endocrine.
   c. defense.

   In describing these functions, reference must be made to the following key concepts: respiration and body metabolism is inter-related; lung has extremely high metabolic activity; and lung disease is often associated with non-respiratory disease and visa versa.

2. Given a set of histologic slides of various normal tissue differentiate lung tissue from other forms of tissue and for the lung tissues identify the arteries, veins, and airways as well as the different types of cells, particularly type II.

3. Given a model, drawing or cadaveric specimen of a whole lung, identify it as either the right or left lung and give the rationale.

4. On a human cadaver or living human subject be able to trace a surface projection of the lungs, all major landmarks related to the lung and state the lungs' spatial relationship to these landmarks.

5. Describe pulmonary, lympatic and bronchial circulation in terms of the following key concepts:

   a. blood supply of the lung.
   b. anatomy of pulmonary circulation.
   c. the lymphatic drainage of the lung.

6. Describe the major developmental changes, resulting from aging, in the respiratory system from neonate to adult.

7. State the anatomical reasons for localization of the lesions of the following states:

   a. emphysema
   b. T.B.
   c. pulmonary edema
   d. bronchogenic carcinoma
   e. cigarette smoking

8. Given appropriate spirometric data be able to differentiate an obstructive from a restrictive chest disease.

9. Given the following information:

   a. arterial blood gas data.
   b. studies on mechanical properties of the lung.
   c. acid-base data.
   d. spirometric data.

   explain the principles of measurement underlying this data and be able to interpret the results to determine the possible physiologic cause(s) and correlate the findings with case history data resulted to the respiratory system (signs, symptoms, drug data, behavioral data).

10. Given a set of unlabeled curves showing various O_2 and CO_2 dissociation relationships, identify the normal curve and explain the physiologic significance of each portion of the normal curve. For each abnormal curve give possible factors which could produce those curves.

11. Given a case history of arterial hypoxemia be able to select and describe the mechanism involved in this particular case and give the rationale for the selection.

12. Describe the mathematical relationship between the cascade effect among and the exact composition and possible sources of error in measurement of each of the following gases:

    a. inspired.
    b. alveolar.
    c. arterial.
    d. mixed venous.
    e. expired.

13. Draw a normal V-Q line, describe its physiological significance and enumerate causes and effects of uneven V-Q giving reasons for the effects.

14. Given values describing lung diffusing capacities be able to:

    a. describe principles of measurement.
    b. the merits and demerits of the values.
    c. identify each value as normal/abnormal and at rest or under exercise conditions.

15. List all of the physiological and clinical significance of arterial pCO_2.

16. Describe in complete detail, including the chemistry and physiology, the exchange of O_2 and CO_2 both at the lung and at tissue sites.

17. Relative to body acid/base balance be able to:

    a. state the sources of H^+ and its disposal.
    b. state the relative importance of different body buffer systems.
    c. describe the classification of acid/base balance.
    d. describe body compensations in acidosis and alkalosis.
    e. using case history data with blood, gas and acid/base data provided be able to arrive at a possible physiologic diagnosis.

18. Describe the neural, chemical and reflex control of respiration under normal conditions, in exercise conditions and with changes in altitude and further describe the six patterns of respiration in man with CNS disorders.

19. Describe the effects of CSF composition on breathing.

20. Describe the importance of exercise tesing to assess pulmonary function.

21. Describe fetal and newborn respiration and list their special problems with regard to respiration.

22. List all types, causes and effects of hypoxia and hypercarbia.

23. Describe all possible problems of respiration during anesthesia and the bends.

24. Define precisely, list the causes of and list all pulmonary function studies needed for acute and chronic respiratory failure.

25. Describe how pulmonary surfactant is formed and its physiologic importance in health and under given pathologic states.

Cumulative Objectives
Renal Block
Sequence I
October, 1976

1. Given a case with a diagnosis or information necessary to determine a diagnosis, including data necessary to calculate or estimate glomerular filtration rate, the student will:

   a. calculate or estimate GFR.
   b. identify GFR as normal, elevated or depressed.
   c. list all possible combinations of directional changes in BP, renal arteriolar tone, plasma oncotic pressure, tubular hydrostatic pressure, tubular osmotic pressure, filtration area and permeability which could produce this ΔGFR or an unexpected failure to change.

2. Describe suitable procedures for measuring rates of renal plasma flow and GFR in humans. Explain why this process is not normally used.

3. The student will identify the range of blood pressure values not resulting in appreciable changes in renal plasma flow and will explain the mechanism which maintains renal plasma flow at the same rate in spite of blood pressure changes.

4. Given a case presentation which includes values for BUN and creatinine the student will describe expected findings in terms of each of the following:

   a. diet.
   b. body weight.
   c. glomerular filtration rate.
   d. rate of urine production.

5. Given abnormal values for the following substances, select from a list of specified diseases those which could produce the abnormal values and explain the changes in kidney functioning which are responsible for those abnormal values in those diseases.

Substances	Diseases
glucose	diabetes
calcium and phosphate	renal glycosuria
amino acids	chronic renal failure
uric acid	various aminoacidurias
protein	cytolytic disease
	gout
	uric acid lithiasis
	glomerular disease
	orthostatic and idiopathic proteinuria

6. Given a disease from the attached list, the student will:

   a. select from a list of substances those which would present as abnormal values in that disease.
   b. indicate whether each value would be high or low.
   c. explain the changes in kidney functioning which are responsible for the abnormal findings.

Substances	Diseases
glucose	diabetes
calcium and phosphate	renal glycosuria
amino acids	chronic renal failure
uric acid	various aminoacidurias
protein	cytolytic disease
	gout
	uric acid lithiasis
	glomerular disease
	orthostatic and idiopathic proteinuria

7. Given specific variations in one or more of the following conditions:

   1) dietary intake
   2) infusion of NaCl concentrations
   3) disruptions caused by:
      acute renal failure
      chronic renal failure
      edema
      pathological changes in the reninangiotensin-aldosterone axis
      administration of diuretics
      alterations in the ultrastructure of the glomerulus

   a. describe expected changes in concentration of sodium and water in each of the following body spaces:

      1. intracellular
      2. interstitial
      3. vascular

   b. describe the process by which the body's content concentration and distribution of sodium and water are regulated directly or indirectly in response to these variations.

8. Given a case presentation which includes values for pH, HCO_3, PCO_2, total CO_2, or any two of these, the student will:

   a. define the condition in terms of simple/mixed, metabolic/respiratory, acidosis/alkolosis, compensated/uncompensated.
   b. identify causes that might produce these values based on information presented in the case.
   c. predict and explain the responses of the body buffers, the lung, the kidneys, and the body's content and distribution of K^+ during compensation or in response to therapy.

9. Given a case presentation where congenital abnormalities, neurological lesions and/or obstructions to the urinary tract are present, or information necessary to deduce the abnormality, lesion or obstruction, the student will describe how these conditions:

   a. alter normal mechanisms of urinary tract flow and mieturition.
   b. interfere with the defenses of the tract against infection.

Cumulative Objectives
Gastrointestinal Block
Sequence I
November, 1976

1. Given a patient history which includes a typical daily dietary intake in which all ingested foods are broken down into component nutrients and having access to an RDA table, be able to:

   a. Identify any nutritional deficiencies or excesses and describe the major clinical manifestations of such deficiencies or excesses.
   b. Describe specifically how you would modify this particular patient's diet to correct any deficiencies or excesses.

2. Given a dietary intake chart which includes amounts of various nutrients found in a specific food, be able to trace any one of those foods (with all of its components) through the digestive tract, including in your discussion as many of the following areas as may be specified:

   a. motility
   b. secretion and action of GI hormones
   c. secretion into the alimentary canal
   d. digestion
   e. absorption
   f. metabolism of absorbed nutrients
   g. excretion

3. Describe in detail the mechanisms involved in regulation of body temperature.

4. Describe embryological development of all major GI structures.

5. Given a set of histologic slides of various normal tissues of GI structures, be able to differentiate between these structures and between tissues from other systems.

6. On a human cadaver or living human subject, be able to trace a surface projection of major GI structures, all major landmarks related to the structures, and state the spatial relationships of each to these landmarks.

Cumulative Objectives
Endocrine Block
Sequence I
October, 1976

1. Describe the anatomical location of all the endocrine glands.

2. Describe the embryological origin of all endocrine glands.

3. Describe the mechanism of action of steroid and polypeptide hormones.

4. Given tables of normal values, appropriate laboratory and physical examination data from list A, and patient history data which is adequate to define an endocrine disorder from list B:

   a. identify the disorder.
   b. describe expected changes in bone, protein, fat and carbohydrate metabolism.
   c. account for the laboratory findings in terms of feedback control mechanisms where possible.

List A Laboratory and Physical Examination Data	List B Endocrine Disorders
RIA	Cushings
17OHCS	Addisons
17KGS	Adrongenital Syndrome
17KS	Diabetes Insipidus
Pregnanetriol	Groves
Cortisol	Hypothyroidism
Urine Na, K, H_2O	Hyperthyroidism
Blood Na, K, Ca, PO_4	Hashimoto's Disease
Plasma II, deoxycortisol	Cretinism
Plasma ACTH	Diabetes Mellitus
Pituitary Reserve Test	Myxedema
Metyrapone Test	Insulinoma
Dexamethasone Test	Hypoparathyroidism
Urine volume	Hyperparathyroidism
Urine Spec. Gravity	Pseudohypoparathyroidism
Plasma osmolality	Rickets
Water Restriction Test	Osteomalacia
Hypertonic Saline Infusion Test	Acromegaly
Nicotine Test	Giantism
Pitressin Test	Dwarfism
Urine Osmolality	
Wolf-Chaikoff effect	
Serum T_3, T_4, TSH	
131_I Uptake	
Serum PBI	
BMR	
Serum Cholesterol	
Achilles Reflex Time	
Thyroid Suppression	
TSH Stimulation	
TRH Stimulation	
Blood Glucose	

(Continued)

List A
Laboratory and Physical Examination Data

Urine Glucose
Blood Insulin
Blood Glucagon
Vit. D assay
Chvostek's sign
Trousseau's sign
Plasma Alkaline phosphotase
Plasma Citrate
Plasma Mg
Hydroxproline
PTH
C-amp
Plasma Protein
Urine PO_4
(All Hormones)
Growth Hormone Stimulation Tests
Glucose Tolerance Test

5. Given appropriate clinical data and tables of normal values revealing specific fluid/electrolyte problems, name the clinical disorder and give the reason for choosing that particular disease entity or process by accounting for each piece of lab data.

6. Given appropriate clinical data, which indicate a growth problem resulting from one of the following:

   a. growth hormone deficiency
   b. hypoparathyroidism
   c. increased cortisol
   d. hypothyroidism identify the appropriate problem and explain why growth does not occur normally in a patient with this particular problem.

Cumulative Objectives
Reproductive Block
Sequence I
October, 1976

1. Given a case history of ambiguous genitalia and/or abnormal endocrine function with information including signs, symptoms, and laboratory data, and with or without a diagnosis:

   a. list the findings that indicate excessive, insufficient or normal androgen and/or estrogen production.
   b. state the genotype of the patient giving reasons for selecting that genotype.
   c. identify and interpret all values given for steroid and gonadotropin concentration in serum or urine.
   d. state the rationale for the usage of the following specific common endocrine stimulation or inhibition tests, or hormonal treatments and describe the information that will be obtained from such procedures:

      1) LRH stimulation
      2) Estrogen administration
      3) Androgen administration
      4) HGC

   e. indicate whether the patient is fertile and give reasons for your conclusion.
   f. explain the precise nature of the problem displayed by the patient, the underlying causes and, where appropriate, further tests which could be performed to confirm the diagnosis.
   g. describe a course of treatment.
   h. for any of the following specific ages at which the patient is first seen (ages: Birth, 2 yrs., 16 yrs.) recommend the sex in which the patient should be raised and justify the recommendation. The recommendation should consider genetic, embryological, anatomic, physiological development of that age individual with that type of problem.

2. Given laboratory data providing information on steroid and/or gonadotropin concentrations in serum or urine, and either a) menstrual history, ovulatory frequency and fertility, or b) sperm count, semen volume, sperm motility index, seminal fluid chemistry and fertility, identify from the following list of pathological and non-pathological states the condition that best fits the available laboratory data.

Pathological	Non-pathological
a. Turner's syndrome	a. Pregnancy
b. Klinefelter's syndrome	b. Menopause
c. Eunochoidism	

3. Given a) experimental or clinical data on steroidal, gonadotropin releasing hormone concentrations in either serum or urine, b) organ ablation or administration of steroid gonadotropin releasing hormone or other endocrine agent, describe the outcome of such conditions or treatments.

4. Given steroid and gonadotropin profiles (in serum or urine) and/or pictures depicting histological changes of the oviduct, uterus, vagina and ovary, the student will name the stage of the menstrual cycle represented and describe the physiological function served by each change.

5. Given profiles of steroidal, gonadotropin and other placental hormones during the trimesters of pregnancy, the student will:

   a. name the trimester of pregnancy depicted in each profile.
   b. indicate which of these hormones are used in pregnancy diagnosis and describe how pregnancy is determined.
   c. indicate which hormones are used to determine the health of the fetus and feto-placental unit and describe how each one serves as an indicator of the state of the unit.
   d. describe the physiological role of each hormone in pregnancy maintenance.

6. Given a case history of a reproductive system abnormality with symptoms, signs, laboratory data and diagnostic test results:

   a. give the physiological rationale for each test used.
   b. interpret the results of the tests.
   c. determine the site of the abnormality and its physiological basis.
   d. suggest a course of treatment.

7. The student will be able to discuss in understandable terms:

   a. the major physiological changes that occur during the four phases of human sexual responding.
   b. techniques of heterosexual arousal.
   c. at least four coital positions giving the advantages and disadvantages of each.

8. The student will be able to cite two lines of evidence indicating the importance of ovarian hormones in sexual receptivity in female mammals, and major lines of evidence indicating the importance of testicular hormones in sexual behavior in male mammals.

9. Given a case history of an infertile couple, the student will:

   a. identify appropriate laboratory techniques, examination procedures and tests for determining the source of infertility.
   b. label each of the procedures listed above in terms of the source(s) of infertility each positively identifies or rules out.
   c. identify the possible sources of infertility given results of laboratory tests and examination procedures.

10. The student should be able to describe the available mechanical and chemical (steroidal and non-steroidal) methods of contraception in non-technical terms understandable by a lay person. The description should include: a) contraindications, b) side effects and c) risk factors associated with each method. In the case of the contraceptive pill, the student should be able to give the probably physiological rationale for how the pill prevents conception.

Cumulative Objectives
Immune Systems
Sequence I
October, 1976

1. Describe in physiological, anatomical, and histological terms those tissues concerned with specific adaptive immunity and state:

   a. the interrelationship of the elements of those tissues during specific response to an immunologically foreign substance.
   b. the interrelationship of those tissues and hence the adaptive immune response to other physiological systems or processes, in particular, inflammation, blood clotting, complement and the monocyte macrophages (the reticuloendothelial system).

2. List and briefly describe the major signs and symptoms of the disorders known to arise from:

   a. deficiencies of the adaptive immune system.
   b. central failure of the adaptive immune system.
   c. failure in the relationships of this system with other systems and processes.

3. Describe the dynamics of the antibody response, the cell mediated response, and in particular the underlying cell dynamics during both a primary and secondary response. Using the major concepts of these descriptions explain:

   a. the process of vaccination and the potential function of booster shots.
   b. the process of graft rejection.
   c. the induction of immune-complex diseases.

4. Explain the basis for the specificity of an antibody response and relate this explanation to immunity, allergy, blood and tissue typing, and the selection of donors and recipients in both blood transfusions and organ transplantations.

Cumulative Objectives
Pharmacology
Sequence I
October, 1976

1. Describe the concept of drug-receptor and role of the receptor in the pharmacological action of a drug.

2. Describe how knowledge of bioavailability might influence the prescribing of a given drug.

3. Given the pKa of the drug, make accurate predictions regarding the absorption of the drug from the gastrointestinal tract, and excretion by the kidney.

4. Given the physicochemical properties of a drup (eg. pKa, lipid solubility, molecular size) predict the likelihood of the drug reaching a given body compartment.

5. Given the half-life, volume of distribution, and pKa, make predictions about the rate of elimination.

6. Describe the major biochemical mechanisms of drug biotransformation, and the type of chemical reactions involved in each.

7. State the significance of knowing whether a drug is metabolized by the microsomal enzymes and state how this might alter ones prescribing practice.

8. Given a specific metabolic reaction, identify the oxidations, reductions, hydrolysis and conjugation.

9. Describe the influence of drugs on the metabolism of endogenous and environmental compounds.

10. Given the half-life, and volume of distribution at a drug and/or therapeutic plasma level, be able to make decisions regarding the dose, and dosing-interval.

11. Given two drugs with different half-lives, predict which one will reach steady state if the maintenance dose is administered.

12. Explain the significance of plasma protein binding in drug therapy.

13. Explain the process by which drugs get into the urine, and steps that physicians can take to alter this process.

14. Name at least two classes of diuretics and explain how they work.

15. Describe the action of cardiac glycosides on myocardial contraction, and explain how diuretics can alter the action of cardiac glycosides.

16. In general terms describe how such things as age, body weight or size, sex, genetics, and disease state can alter the individual's response to a drug.

17. Given several dose-response curves using agonists and antagonist, be able to explain the events producing the curve.

18. Be able to describe the basic mechanisms of antibiotics.

Cumulative Objectives
Introduction to Epidemiology
Sequence I
October, 1976

1. Given a specific research study or an excerpt from a study, previously unencountered, the student, using the appropriate concepts and skills listed below will determine the relative validity of the findings and consequently the value of the information giving rationale for his conclusions. The concepts and/or skills that may be applied are as follows:

   a. method of sampling and randomization.
   b. types of research designs including their strengths and weaknesses.
   c. the effects of different types of bias including selective survival, selective recall, attrition, ecologic fallacy, Berkson's fallacy and selection.
   d. types of association and the proper criteria for causal interpretations.
   e. proper interpretation and reading of control and/or two by two tables.
   f. reliability and validity of measurements.

2. Describe the epidemiologic transition of disease and its relationship to medical advances, social and economic changes in the population, and its implications for the practice of medicine.

3. Compare and contrast the underlying concepts involved in infectious disease and/or chronic disease epidemiologic research. Such a comparison should include the factors of:

   a. the host-agent-environment concept.
   b. the concept of hierarchial levels of response.
   c. problems of multiple causation.
   d. the utility of the germ theory.
   e. the status of research on social, psychological and environmental factors in infectious and chronic disease etiology.

Cumulative Objectives
Medical Sociology
Sequence I
October, 1976

1. Given hypothetical paper case studies, identify and discuss common sociological ideas, concepts, and problem areas (opinions, attitudes, beliefs, folkways, mores, norms, personality, culture, occupation, educational level, income, life style, family, peer groups, religious beliefs, national descent, social mobility, socialization, values, sex, and demographic characteristics) relating to patient behavior (sick role, illness behavior, compliance/non-compliance, patienthood, self-medication, denial/acceptance, recovery, rehabilitation), medical treatment (doctor-patient relationship, professionalism, depersonalization, dependency, outcomes), and health institutions (hospital bureaucracy, professional autonomy) by writing an analysis of the case studies with resources.

Cumulative Objectives
Medical Humanities:
Sequence I
October, 1976

1. Given a specific ethical decision the student will be able to reproduce a diagram showing the interrationships among the following ethical judgement-making strategies, and be able to give a verbal strategy in arriving at the ethical decision.
   a) deontological theory (act and rule)
   b) teleological theory
      1) egoism
      2) act utilitarianism
      3) rule utilitarianism

2. Given an appropriate clinical case, the student, after discussion small group setting with his/her peers, will produce an outline of an ethical method for dealing with the problem involved in the case. In doing this the student should include:
   a) a clear statement of the ethical questions involved.
   b) formulation of an ethical judgement on what ought to be done in such a form that further debate and discussion will be possible.
   c) determination of the consequences of acting on the bases of that judgement in order to evaluate it on teleological grounds.
   d) determination of whether these consequences are in conflict with some personally held deontological values.
   e) an attempt to arrive at a revision of the initial judgement which takes into account any conflict which has been discovered between the good of the predicted consequences and the values which seem to be over-riding.

3. The student by the end of Sequence I will be able to give an overview analysis of the value issues common to all of the following areas in terms of:
   a) the social role of the physcian/patient relationship
   b) the good of the individual versus the good of society
   c) the derivation of rights, of the individual, of the physcian, of society
   d) the value priorities placed upon length of life, quality of life and self determination when these seem to be in conflict:
      abortion
      genetic counseling
      treatment of the defective newborn
      euthanasia
      suicide
      informed consent
      physcian/patient confidentiality
      control of behavior via psychosurgery or psychotropic drugs.

CUMULATIVE OBJECTIVES
INTRODUCTION TO CLINICAL MEDICINE
SEQUENCE I
October 1976

1. Given excerpts from a videotaped medical interview, the student will be able to:

   a. Identify examples of process and content as defined in ICM I, Module 1.

   b. Identify examples of 1) open-ended, 2) closed and 3) biased questions as defined in ICM I, Module 2 and indicate appropriate uses and misuses of each of these interviewing techniques.

   c. Identify examples of 1) facilitation, 2) confrontation, 3) silence, 4) support and 5) reassurance, as defined in ICM I, Module 2, and show the adaptive uses of each.

2. Given a real or simulated patient, the student will be able to:

   a. Conduct the interview according to "S.I.U. Guidelines for Student-Patient Contact." (Appendix A, ICM I, Module 3), and initiate the information-gathering phase of the interview with an open-ended question.

   b. Demonstrate an ability to identify and interpret behavior which expresses feelings as well as an ability to adaptively respond to emotion-laden topics.

   c. Use supportive techniques (as described in ICM I, Module 5) to acknowledge the expressions of feelings on the part of the patient and to terminate the interview (maximum length 10 minutes).

   d. Without reference to an outline, guide the interview so as to obtain the data necessary for the four parts of the medical history (as defined by ICM I, Module 6) and demonstrate skills designed to facilitate spontaneous communication from the patient.

3. Emergency Medicine. Without the use of reference books or notes, the student will be able to:

   a. Perform cardiopulmonary resuscitation on a mannikin according to Illinois Heart Association guidelines (ICM I/Em Med, Module 1.0).

   b. Given a situation producing hypovolemic shock, assess the emergency and institute appropriate measures to stop hemorrhage and provide initial treatment for hypovolemic shock (ICM I/Em Med, Module 2).

   c. Given a situation likely to produce vertebral column injuries, assess the emergency following the guidlines of the initial Emergency Evaluation Procedure and institute appropriate emergency measures to reduce the possibility of further injury (ICM I/Em Med, Module 3).

4. Given a real or simulated patient, the student will:

   a. Perform a screening physical examination as outlined in Bates, pp. XVI-XVII and 1-7.

   b. Write up the findings as outlined in Bates, pp. 314-319.

   The examination must include all components listed in Bates and must be performed in proper sequence.

BSSH ESSENTIAL GOALS
MEDICAL PSYCHOLOGY
1976-77

1. Perception

   a. Be able to indicate what factors will determine whether or not a patient will report the presence of a perceptual stimulus.
   b. What factors must a physician take into account when assessing the severity of a patient's report of pain.

2. Individual Differences

   a. Contrast the procedures utilized in measuring intelligence as typified by:
      (1) the Stanford-Binet and WAIS
      (2) Infant tests
      (3) "Culture Free" tests
   b. Be able to discuss the problems associated with the use of the term "I.Q." including the controversy over the degree of inheritability.

3. Learning and Conditioning

   a. Be able to correctly use the following terms pertaining to learning and conditioning.

      (1) stimulus
      (2) response
      (3) reinforcement
      (4) punishment
      (5) classical conditioning
      (6) operant conditioning
      (7) generalization
      (8) discrimination
      (9) extinction

4. Physiological Mechanisms of Learning and Memory -- Outline the essentials of one theory of memory formation paying special attention to the differentiation of short-term and long-term memory.

5. Learning and Memory Disorders -- Differentiate between the nerve pathology present in KORSAKOFF's Syndrone and ALZHEIMER's disease. (Note: Caps are for ease in spelling).

6. Mental Retardation -- Give the etiology, neuropathology and therapy for two classes of metabolic disorders that result in mental retardation.

7. Neuropharmacology of Drug Abuse -- Identify the five classes of drugs subject to abuse and indicate the degree that each produces psychological dependence, physical dependence, addiction and tolerance.

8. Behavioral Considerations of Abnormal Genitourinary Organs -- Indicate the most important factor that will determine gender identity in humans.

9. Sexual Techniques: Facts and Fallacies -- Indicate five major fallacies about sexual behavior that are widely accepted as true in our society.

APPENDIX TEN

PROJECT EVALUATION REPORT

COMPETENCY MAINTENANCE STRATEGY

REVIEW & EVALUATION REPORT I

NOVEMBER 1, 1976

SUBMITTED TO REED WILLIAMS, PH.D.
BY BETH DAWSON

AN INTERNAL EVALUATION OF THE COMPETENCY MAINTENANCE STRATEGY PROJECT

The present report is the first of eight quarterly evaluation reports on the Competency Maintenance Strategy Project (Project No. OEG - G007603938). The period of time covered by this report is the two month period of September, October 1976. This report is being submitted one month early to provide information that may be useful in the summary of project activities occurring under the initial planning (Project No. OEG - G007502225). As such, it contains the initial impressions and insights gained during evaluation activities; many of these will be expanded and perhaps modified through the course of future evaluation efforts.

The present report has been written independently by the internal evaluator. Many of the issues have been discussed with the external evaluator, Dr. Robert E. Stake, Director of the Center for Instructional Research & Curriculum Evaluation, University of Illinois. However, responsibility for the contents of this report is that of the internal evaluator.

Beth Dawson
Internal Evaluator
Associate Director,
Statistics & Measurement

GENERAL OVERVIEW

The Competency Maintenance Strategy project aspires to restructure portions of the competency based curriculum at Southern Illinois University School of Medicine to promote retention of essential concepts and skills. The plan calls for methodical identification of key competencies and development of appropriate assessment methods to evaluate student performance. Systematic methods of teaching application and integration are to be developed to increase levels of retention.

The activities during the first year of a three year commitment have been concentrated on definition and development of the system for Sequence I, the first year of the curriculum. The project is directed by Reed Williams, Ph.D., who supervises two professional staff members. Dr. Williams works closely with the Sequence I Coordinator of Educational Resources, Roger Robinson.

The project is comprehensive and well planned. If successful, a major restructuring of the medical school curriculum will be accompanied by carefully developed examinations and mechanisms to allow students to rehearse and thus increase retention of essential competencies. Any project of such wide-reaching scope is highly dependent upon the active cooperation of administrators and faculty. Such support is evident in Sequence I, the curriculum segment in which project activities have predominently occurred to date. The administrators responsible for Sequence I are enthusiastic and actively involved in project efforts. The faculty interviewed thus far approach activities defined by the project as a natural extension of curriculum development and revision; they do not view the project as an external imposition on their efforts. All indications at the present time point to general faculty support, although only a small sample of faculty have been interviewed.

Project activities are being adeptly coordinated and supervised. It is apparent that the Sequence I Coordinator has excellent rapport with faculty and deserves commendation for the manner in which he is assisting with the instrumentation of project activities. The Project Director is sensitive to faculty ideas and encourages maximum flexibility while still accomplishing the objectives of the project. The teamwork between the administrators, faculty, and director is a major factor in the development of the project to date.

INITIAL FINDINGS RELATED TO THE OBJECTIVES OF THE PROJECT

Survey of existing objectives for Sequence I was completed prior to the beginning of formal evaluation activities. Results of the survey were provided to faculty block coordinators in Sequence I for their use in identification and definition of cumulative objectives reflecting key competencies. The use of survey results by block coordinators has varied; indications are that the results were moderately helpful. Apparently, portions of the curriculum underwent substantial revision subsequent to the survey -- rendering the results outdated and/or irrelevant.

An informational meeting was held in early October to discuss the project with Sequence II faculty responsible for curriculum revision. The survey of objectives is scheduled to occur near the very end of this sequence. Efforts should be made to provide faculty team leaders with survey results soon after the sequence is completed and before subsequent revisions begin to occur.

Identification and definition of block and sequence cumulative objectives has been completed for most of the organ system blocks in Sequence I. This process is seen as leading directly to the development of block and sequence cumulative modules. Cumulative objectives were developed by each block independently but in consultation with the Sequence I coordinator and/or the project director.

Initial evaluation data were obtained from interviews with four members of the faculty and form the basis for the impression that considerable procedural flexibility was encouraged in the actual mechanisms used to develop cumulative objectives. Some block coordinators involved various faculty from the block for which they were responsible. Others worked alone or with the Sequence I coordinator. Two faculty stated that the process of writing cumulative objectives proceeded smoothly. A third faculty member expressed the concern that cumulative objectives embodying application and integration are more difficult to identify for some content areas. These faculty were in general agreement that the project activities are worthwhile.

The collection of cumulative objectives developed by block coordinators will be used as the cumulative objectives for Sequence I. Project personnel gave extensive consideration to the advisability of further integration of objectives across organ system blocks. Higher level integration is viewed as very desireable, but a major problem exists in implementing such inter-block objectives. If students are to perform satisfactorily on such objectives, they need opportunities to learn and practice higher level application and integration methods. This might be accomplished through an end-of-sequence block devoted to integration of ideas and concepts across blocks. Alternately, each successive block could build upon and integrate concepts from previous blocks. Either approach would require rescheduling of the curriculum to provide the necessary time, either at the end of Sequence I, or to blocks occurring later in the sequence.

The decision to treat the set of block cumulative objectives as the sequence objectives appears to be appropriate for the present academic year. Attention should be given to this problem and alternative solutions should be explored for future years.

Assessment procedures for block cumulative exercises have been developed for the neuroscience block in Sequence I. The exercises are formatted in a case approach with information not requiring retention being presented as data given in the introduction of the case. Future evaluation reports will examine the methods of establishing the reliability and validity of this type of examination.

Sequence I cumulative exercises were under development at the time this report was completed. Teentative plans call for the examination defined by these exercises to be administered to the present class as a pilot examination. No promotion decisions are to be made on the basis of the pilot examination.

The following plan to validate the Sequence I cumulative examination is suggested for consideration by the project personnel:

1. Administration of the examination would occur either at the end of Sequence I or at the beginning of Sequence II, immediately following the move to Springfield. In either case, results of the examination would <u>not</u> be communicated to students or any faculty involved in the promotion decision process. (This might require postponement of scoring should the examination be administered at the end of Sequence I.)

2. All promotion decisions would be based on the criteria normally utilized. Decisions would be recorded for each student, noting the special cases in which a decision to promote or to repeat was extremely difficult to make.
3. Following the promotion decision making process, the examination scores would be determined and the decision that would have been made on the basis of the examination score alone would be recorded for each student.
4. Decisions would be compared for agreement. Special attention should be given to those cases in which there is disagreement. Examination of the items missed by students for whom incorrect decisions were made should provide insights into interpretation and revision of the examination.

The above plan is not intended to replace determination of content validity and assessment of test reliability by traditional methods.

Rehearsal activities have been developed for the neuroscience block. The nature and impact of these activities will be evaluated in a future report.

FINDINGS RELATED TO ISSUES

The identification and study of issues is an important component of any evaluation that attempts to document aspects of a project that have relevance to the wider educational community. Issues are also important to project personnel. They remind participants of important areas that require attention; they serve as indicators of ways that procedures may be improved; they address broader concerns that need to be remembered.

Several issues were suggested in the project proposal. These issues and others that arise as the project proceeds will be addressed in a section of each quarterly report.

* * * *

ISSUE: What is the impact of the competency maintenance system on the school? How do faculty view the development and maintenance of the procedures? Do students react in a positive manner? Do administrators feel the project is worthwhile?

Initial evaluation findings are just getting underway in Sequence II and cannot be evaluated at the present time. Faculty appear to view the development of cumulative objectives and exercises as a natural extension of curriculum revision. Administrators are doing more than giving verbal support; they are actively participating with faculty and project personnel in defining procedures to implement the system. Student reactions have not yet been probed. Examples of reactions of Sequence I faculty and administrators, paraphrased from interview comments, include:

> My curriculum block was being reorganized along these lines last year. We view the task as the identification of goals in a given module that also relate and rely upon goals in earlier modules. We try to determine those aspects of the curriculum that are needed to deal with clinical problems.
>
> I hope that my curriculum block will be developed into a system that is compatible and integrated with the rest of the curriculum, especially in Sequence I. But I always hope to be revising my block. I expect changes to continue, even five years from now.

> The faculty in Sequence I have quite an appetite for new and innovative ways to teach. This is one of the reasons we chose the organ system approach. Integrating material over blocks is a challenging problem, but worth tackling.

A concern raised by one faculty in discussing this issue was that the amount of time available for curriculum revision may decrease. It was feared that faculty may be pressured to "complete" the curriculum so that more time would be devoted to basic research and publishing.

* * * *

ISSUE: What special difficulties, if any, are encountered in implementing this system? Does the procedure work better with some types of contents than others?

Initial indications are that this issue may be worth pursuing, although it has been addressed only superficially thus far. Most blocks in Sequence I are integrated in nature due to the organ system organization of the curriculum. These blocks appear to lend themselves to fairly easy definition of cumulative objectives. The blocks that represent more traditional subject areas may experience greater difficulty in developing integrated objectives. This issue will be further probed in future reports.

* * * *

ISSUE: Does the emphasis on application and integration require too much time? Do faculty feel overburdoned when teaching for these abilities is added to the regular curriculum? If there is more to teach in the same amount of time, what kinds of materials are eliminated and why?

The information obtained from faculty on this issue is mixed. One faculty stated that the cumulative objectives do not require new factual information; they require only integration and application of previously learned material; thus they will not require additional teaching time. Another faculty expects that teaching the cumulative objectives will result in elimination of some of the old objectives, but that this may be a beneficial result: perhaps some of the old objectives are irrelevant and should be dropped from the curriculum. It seems reasonable to expect that emphasis on application and integration will require additional instructional time for both faculty and students. More data will be collected related to this issue.

* * * *

ISSUE: Is individualization deterred by this approach to curriculum organization? Is it necessary that all students acquire the same basic competencies? What provisions are made for students who have difficulty acquiring the common base of knowledge? What provisions are made for students who attain the common base with ease?

A frequent criticism of competency-based curricula and criterion-referenced assessment methods is that they attend too much to factual recall. This criticism is not without substance. Many such systems, in an attempt to break down or molecularize specific learning tasks, do result in a curriculum that is a collection of parts. The corresponding methods of testing concentrate on measuring learning of those parts. The faculty and project personnel are to be commended for their insights and recognition of this danger. The current project is viewed a way to integrate the important parts or competencies into a comprehensive whole once

again. But a better curriculum should result for having gone through this process. If successful, the new system will consist of well-defined important competencies that have been integrated across curriculum content areas.

There are indications that both administrators and faculty recognize the questions raised in this issue. Paraphrased comments from interviews include the following:

> We really do not know which specialty students will choose. Therefore, the goal for undergraduate medical education is to provide a common base of materials related to common patient problems. However, we recognize that some students have the capacity for more. We are currently trying to develop some experiences for students who are just whizzing through and are eager for some additional kinds of learning.
>
> The experiential base is very important to both the scientist and the physician. We must maximize these types of experiences for students so they become more adept in utilizing experiential material.

* * * *

ISSUE: Should there be greater emphasis on how to use resource materials and less on information recall?

An attempt is being made to de-emphasize undue testing of facts that need not be retained on an instant recall basis. For example, the case format is being used for the block cumulative examinations and is planned for sequence cumulative examinations. These items present students with a "case" or problem in which problem-solving kinds of decisions must be made. The facts needed to work the problem, but not required to be committed to memory by students, are presented in the case or problem opening statement. Further attention should be given to the kinds of curriculum materials that best lend themselves to teaching for reference. Future evaluation activities will be devoted to additional examination of this issue and some of its implications for retention in learning.

* * * *
* * * *

A number of additional issues were identified through interviews and observation. These issues have not been examined sufficiently to allow comments at this time. They will be addressed in future reports.

ISSUE: How is the success of retention measured? Do the cumulative objectives and the teaching for integration and application result in better retention on the part of students?

ISSUE: What is the best method to provide students with the opportunity to rehearse essential competencies? How do these activities impact teaching time? Is consideration being given to activities that allow students to work in groups? to activities that are not teacher dependent? to alternate systems such as computer assisted?

ISSUE: Does the increased emphasis on integration, application and retention result in a slower progress rate? Will students end up learning better, but less?

ISSUE: How do students study for this type of curriculum? Do they develop strategies that might defeat the system? In spite of attempts to make it otherwise, do students still view this system with anxiety and fear of failure?

EVALUATION ACTIVITIES AND METHODS

Evaluation activities for the first report have concentrated on gathering background information on the curriculum and establishing relationships with faculty and administrators, primarily in Sequence I. Formal activities include the following:

Conversations with Assistant Dean for Faculty
Assistant Dean for Curriculum Affairs & Educational Resources
Coordinator for Educational Resources
Project Director
Four Sequence I faculty
One Sequence I student;
Attendance and observation a one-day working session on progress of the project in Sequence I;
Attendance and observation at a meeting to introduce project objectives and plans for Sequence II;
Examination of curriculum materials, sample block examinations.

Future activities will include continued attendance and observation at working meetings; additional interviews of faculty and students; survey of students and faculty on three or four essential issues to obtain baseline data on attitudes and perceptions; collection and assessment of data on student performance both prior to and subsequent to implementation of this project; examination of curriculum materials and exercises.

University of Illinois at Urbana-Champaign

College of Education
CENTER FOR INSTRUCTIONAL RESEARCH
AND CURRICULUM EVALUATION (CIRCE)
270 Education Building
Urbana, Illinois 61801
(217) 333-3771

November 8, 1976

Reed Willimas
Southern Illinois University School of Medicine
Springfield, Illinois 62700

Dear Reed,

This is to indicate my full endorsement to the First Quarterly Evaluation Report for your Competency Maintenance Project submitted by Beth Dawson November 4. (It is my understanding that the report actually is due December 1 and that the next one will be due March 1.) I reviewed the contents--in a general sense--rather thoroughly with Beth and feel that she effectively described our thinking about the evaluation so far in this report.

I would like to urge you to give particular attention to the plan (beginning on page 2) she and I sketched for the validation of the Sequence I cumulative examination. This may or may not be a practical way of satisfying the need, but I am hopeful that some such way can be found of accomplishing the validation.

It seems to me that the greatest danger the project faces is that sufficient cooperation will not be generated from the faculty, even that opposition will emerge to the further specification and formal integration of student competences. Several of the issues we have raised relate to this concern. We will be directing many of our observations to satisfy ourselves that you are clearing that important hurdle.

It is a pleasure to be working with you on this ambitious project. I look forward to further discussion of it.

Cordially,

Robert E. Stake
Director

RES:ja

cc Beth Dawson

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APPENDIX ELEVEN

SUMMARY OF ASSESSMENT METHODOLOGIES

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SUMMARY OF ASSESSMENT PROCEDURES

Prepared by:

Beth Dawson DOHSIS

Janet McDole CAER

Sue Wingrove CAER

Southern Illinois University

School of Medicine

Springfield, Illinois

June, 1976

This document was prepared under the direction of Reed G. Williams, Ph.D., Associate Professor of Medical Education, S.I.U. School of Medicine and its preparation was supported by a grant from the Fund for Improvement of Post-Secondary Education.

SUMMARY OF ASSESSMENT PROCEDURES

ASSESSMENT PROCEDURE	ABILITIES MEASURED	ADVANTAGES	DISADVANTAGES	RELIABILITY	VALIDITY	TIME COMMITMENT	GENERATION OF NEW ITEMS	SCORING	SPECIAL EQUIPMENT	OTHER	GENERAL IMPRESSIONS
Patient Management Problems (PMP): A brief written clinical description of a patient and his problem(s) are provided and student can seek additional information by selecting cards or revealing items in attempt to arrive at diagnosis and treatment.	Integration and application of cognitive knowledge and problem-solving abilities.	Closely models a broad range of actual clinical situations. Allows evaluation of process involved in arriving at answer. Standardization of testing situation.	Provides excess cueing. The structure produces some artificiality due to constraints imposed by response options. Also incapable of measuring student psychomotor capabilities.	Reliability difficult to assess by traditional method due to learning that occurs during performance and heterogeneity of "items." Generally considered fairly high since requires logical problem solving skills, but low correlations between performance on different PMP's indicate content specificity. Internal consistency estimates reported in .60 to .80 range.	Content validity high when examining restricted domain. "Face" validity quite high. Criterion validity estimates in .50 to .70 range when compared to objective tests. More research needed to compare to actual performance and to assess predictive validity.	Considerable training needed to prepare PMP's. Scoring time is moderate.	New cases generated fairly easily when general format is established.	Scoring can yield information about student's problem-solving process. Scores may be obtained for efficiency, proficiency, overall competence.	Requires either index cards or specially treated paper to reveal selected responses.	Students and faculty are enthusiastic about PMP's both for teaching and evaluation.	PMP's simulate the clinical situation more realistically than all other paper and pencil tests. Sequential management formats reduce cueing problem.
Medical Audit: Usually refers to reviewing patient records for purposes of evaluating quality of medical care. Performance can be assessed by noting absence or presence of critical items relevant to diagnosis and treatment. Requires clearly defined criteria.	Comprehensiveness of patient care skills including history and physical, lab interpretations, diagnosis and treatment.	Is objective if predetermined criteria used. Non-physicians may be trained in audit procedures. Is flexible--can be applied to inpatient and outpatient care.	Difficult for experts to agree on criteria. Often wide variations in recordkeeping systems, but can be minimized by use of a standard format such as the problem-oriented system. Requires trained auditors.	Reliability generally high even when non-physicians serve as auditors, if criteria for assessment are well established and standardized recordkeeping formats used.	Validity unknown. This method may be a better measure of recordkeeping skills than actual patient care. More evidence is needed to establish relationship between performance and recordkeeping.	20-30 minutes needed by experienced auditor to review each chart. No time required for preparation: time needed to establish criteria.	Not required.	Can be scored using checklists with weights assigned to critical items. Overall impressions can also be recorded. Audit results can be computer analyzed.	None, unless results are computer analyzed.	Feedback has been valuable in improving record-keeping skills. Minimizes cueing: standardized format provides structure without providing direct cues.	Assessment is useful, where criteria have been standardized, in viewing retrospectively total patient care skills. Does not necessarily represent accurately quality of care provided, including certain psychological variables that routinely affect clinical decisions.
Objective Tests: **Formats include:** **Multiple-choice** **True-False** **Matching**	Cognitive abilities: knowledge, understanding, judgment.	Most widely used, high replicability, ease of administration and scoring. Common indexes available to interpret overall test and individual items.	Often only measures recall. Confounded by timed conditions. Tendency to design test for psychometric qualities instead of content.	Unfortunately, stability and equivalence measures are rarely reported because of difficulties in readministering the same test due to remembering or designing parallel forms. Internal consistency estimates range from .70 to .95 for standardized tests; slightly lower for teacher made tests.	Content validity is generally demonstrated by inspection of items; generally acceptable with tests covering a restricted domain. Criterion-related validity varies according to whether the criterion is assessed by objective tests or other methods, ranging from .60 to .90 for the former on standardized tests. Concurrent validity is generally higher than predictive.	Considerable effort required for composing and modifying good test. Small amount of time required for scoring.	Easy for simple items (e.g., dosage levels). More difficult for complex items requiring more than recall or computation.	Very simple and fast to perform: amenable to computerization.	None, but may be facilitated through use of mark sense answer sheets, computerized administration, scoring, item storage, or test generation.	Traditional psychometric properties not always applicable in criterion referenced situation.	Because of traditional acceptance, objective tests are used in many situations where other assessment methods are more appropriate
Essay Tests: **Two types are:** **1) short answer where scope of topic is restricted; and** **2) narrative, where more freedom given for developing response.** **Both types require development of answer--alternatives not provided.**	All levels of ability: recall, comprehension, integration and application of knowledge to the solution of problems. However, does not measure any performance other than writing. Thus student may know what to do and score well on the test but not know how to do it.	Allows student to formulate and express own responses rather than choose among given answers. More closely reflects real life expectations.	Scoring can be unreliable and biased unless clear standards for grading are used. Provides limited sampling.	Stability is questionable due to learning that occurs in developing answer during first administration; equivalent forms almost impossible to design. Scorer bias can be improved by using clear criteria for judging answers, carefully stated questions and scoring grid or key.	Content validity may be compromised due to inadequate sampling of the domain. May be measuring written communication skills rather than content unless scoring is standardized. Criterion validity higher than with objective tests since cueing effects are not present. Both concurrent and predictive validity may be high with well developed exams.	Is great, particularly for scoring, but also for preparing unambiguous questions with adequate scoring procedures.	Difficult, especially for items requiring more complex responses.	Generally difficult and time consuming. Analytic matrix scoring technique most desirable.	None.	Essay tests are often used to assess levels of achievement which objective tests could assess more easily.	Ability to measure comprehension, integration and application makes this procedure highly desirable. Time required can be reduced using short answer format and scoring key. Techniques for improving reliability have been identified

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Oral Examinations: Typically refers to one or more physician-examiners raising questions or posing clinical cases to which examinee responds.	Can be structured to assess a variety of abilities including recall, oral communication skills, problem recognition and solving.	Not limited to a priori responses. Allows flexible interaction between examiner and examinee, probing of why an incorrect response given, and remediation of identified student weaknesses.	Inadequate sampling due to time constraints. Bias on part of examiner difficult to control; sometimes difficult to standardize due to interaction between examiner and examinee.	All measures of reliability are threatened by lack of standardization. Observer bias may compromise reliability. Both may be controlled somewhat by use of several examiners and standardized questions.	Content validity is compromised by inadequate sampling. Communication skills and personality of examinee may bias scoring. Criterion validity unknown; may penalize student who can perform but does not orally present facts well.	Requires considerable time compared to objective testing methods due primarily to separate testing for each examinee.	Specific modifications to standard "cases" are fairly easy to generate once initial repertory of cases developed.	Generally uses standard rating form. Can be objective.	None required unless special materials are required for examination questions.	Purpose should be clearly defined. Examiners need training for objectivity in scoring.	Although a traditional method of assessment, other methods can provide flexibility without some of the disadvantages and costliness in time requirements.
Self and Peer Assessment: Refers to self or peer providing input regarding one's performance. Often used in affective area, but also used in knowledge and skill areas.	Can provide measures of all abilities including knowledge, skills, interpersonal communication, interests, attitudes, etc.	Because both methods may be used to assess many areas, can be helpful in obtaining overall picture of student.	Personal biases or reluctance on part of students to rate their peers may affect ratings. Some students tend to rate themselves lower than do their peers. Others rate themselves higher.	Stability of peer ratings especially good. Most researchers find positive correlations of 0.8 or better. Stability of self-reports generally good, though not as high as peer assessment.	Predictive validity of peer ratings is high. Several studies find peer ratings best predictor of later performance. Content validity of peer assessment especially high in area of interpersonal relationships. Concurrent validity of peer and self ratings generally determined by comparing them with grades. Peer ratings correlate higher than self ratings.	Generally requires little time. More time required in initial preparation of procedure, but once developed, greatly reduces faculty time.	Dependent upon area being assessed and assessment method used.	Dependent upon area being assessed. May use rating scales, checklists, etc. Results may be computer analyzed.	None, unless results are computer analyzed.	Both self and peer assessment are valuable for increasing self-awareness of student. Ability to assess one's self is important process of continuing medical education.	Self assessment is especially beneficia for student; allows inpu and capitalize on student's concern about own performanc Peer assessment can provide insights of fellow students of which instructors may be unaware.
Direct Observation: Refers to the observation method where observer's role is clearly specfied. Observation may refer to a discrete activity or to complex and integrated behavior.	Specific clinical skills, especially interpersonal skills, history-taking and physical examination.	Allows a more holistic picture of complex performance--assesses student behavior in actual clinical situations.	Requires trained observers. Test situation not standardized.	Stability and equivalence difficult to assess for global skills due to non-existence of "identical" situations. Can be assessed for specific skills. Can be increased by use of trained observers and clearly defined criteria. Needs more research on observer bias.	Generally assumed to be valid for assessing those behaviors that are observed. Content validity for general skills threatened unless observations occur in multiple and diverse situations. Measures only those behaviors that are evidenced; student may be capable of performing skills not required in particular situation.	Substantial, both in preparation and in observation activities.	N/A	Flexible. Techniques used depend on particular situation. Can use checklists, rating scales, observer notes, etc.	None, although video and audio-taping can be used.	Method formalizes the prevailing use of informal observation.	The most realistic and flexible assessment method, but presents difficulty with traditional psychometric interpretations.
Clinical Simulations: Refers to computer programs or actor-patients. Students do interviews, perform physicals, order and interpret laboratory findings and receive feedback regarding performance.	Independent clinical problem-solving and interpersonal communication abilities. May also be helpful in probing attitudes.	Students initiate questions and obtain information via visual, auditory and tactile sources. Provides situation for analyzing interpersonal skills and cognitive knowledge in near realistic physician-patient encounters.	Lack of standardization of testing situation when computers are not used. Not conducive to large scale test administration.	Equivalence reliability of actor-patient simulations difficult to determine due to lack of standardization of doctor-patient interactions. However, aspects other than personal interaction can be standardized as in computer simulations. Stability of computer simulations higher than simulated patients due to standardization of format. Degree of equivalence depends upon similarity of simulations being compared.	Limited validity data available. However, concurrent validity assumed high in most cases; content validity is high since patient simulations are developed from actual cases. More research needed to determine predictive validity.	Training is needed for actors and observers and for preparing computer programs, if used. Scoring complex unless done by computer.	New items generated fairly easily for computer simulations once formats are developed. Difficult for actor-patient simulations due to retraining requirements.	Can be accomplished by direct observation techniques, checklists, rating scales.	Actor-patients; computer hardware and access to software if scoring or "case" are automated.	Students need instruction in operating computers, and have objected when simulations are used only for evaluations.	Simulated patients are similar to the true clinical situation. However, much time and effort must be expended in developing both actor-patients and computer simulation

MEDICAL AUDIT

Barro, A. R. Survey and evaluation of approaches to physician performance measurement. Journal of Medical Education, 48:1047-93, Nov. 1973.

Discusses literature describing use of patient records, record abstracts and hospital charts to retrospectively assess physician process. Suggests that patient records are usually used to assess quality of care in hospitals, but can also be used to assess private care. Both record abstracts and hospital charts are infrequently used for assessing individual physician performance. Record abstracts are generally used for statistical display and analysis in hospital utilization studies. Hospital charts are primarily used as a basis for retrospectively assessing outcomes.

Barro points out that there are a number of problems surrounding use of clinical records for performance assessment: information on records is not always standardized, recorded information is often incomplete and inadequate, questionalbe accuracy of recorded statements, records generally don't contain information on management of psychological and social problems, need to develop systematic assessment procedure, and question of relationship between quality of recording and quality of care provided.

Fessel, W. J. & VanBrunt, E. E. Assessing quality of care from the medical record. New England Journal of Medicine, 286 (3):134-138, 1972.

A medical audit procedure was developed in this study to determine if the recorded process of medical care and the actual outcomes are related. Records of the process of care provided patients with appendicites and myocardial infarction and their outcomes were studied. Findings showed that neither quantity nor quality of recorded data was related to outcome of two common diseases.

Hanson, A. S. & Kraus, E. D. An outpatient medical audit. Minnesota Medicine, 49-52, Oct. 1973.

Developed an outpatient medical audit procedure in which non-physician auditors were used. Twenty diagnoses were selected for auditing purposes, and "master criteria" (optimal information that might be included for each diagnosis) was prepared. The non-physician auditors studied an audit manual and audited several charts under direct observation of physician coordinators before auditing on their own. Results showed that non-physician auditors were highly reliable in auditing information from patient records.

Helfer, R. E. Estimating the quality of patient care in a Pediatric emergency room. Journal of Medical Education, 42:244-248, 1967.

A chart review system was developed to estimate the quality of patient care provided in a pediatric emergency room. Expert criteria essential to an adequate history and physical exam were identified by polling staff pediatricians. Patient charts were then reviewed and interns' recordings were evaluated for proficiency, efficiency and competence.

Kane, R. L., et al. A method for evaluating patient care and auditing skills of family practice residents. Journal of Family Practice, 2(3): 205-210, June 1975.

Suggests that the audit may be a valuable tool both for measuring performance and for teaching patient care technique. The audit system described allows separation of knowledge of how to care for the patient as represented by auditing ability and actual patient care skills as indicated by the patient care score.

Results of this study indicated that a resident's charting skill is more responsive to change than is his patient care or auditing skills. (Residents quickly become aware that their charts were being audited and began improving their recording.) Investigators also point out that the inter-rater reliability is low. While the items to be assessed were "controlled", the ultimate judgment of the adequacy of care was left up to the reviewer (auditor). Again, the questionable relationship between charting skills and patient care is mentioned.

Kroeger, H. H., et al. The office practice of Internists. I. The feasibility of evaluating quality of care. JAMA, 193(5):121-126, Aug. 1965.

Describes use of medical audit for evaluating office practice of internists. Used non-physician auditors, however no specific grading criteria was used. Investigators state that agreement among auditors was good, but that development of specific criteria for judging the abstracts of each disease category would greatly improve evaluation of the quality of care in physicians' offices.

Lyons, T. F. & Payne, B. C. The relationship of physicians' medical recording performance to their medical care performance. Medical Care, 12(5):463-469, May 1974.

Reports correlations of two types of measures of the quality of care: those that depend upon the physician's recording and those that are recorded independently of the physician.

Developed criteria for hospital services recommended for optimal care in each of eight diagnostic categories.

Data collected by specially trained abstracters using the basic PAS-MAP abstract form. Constructed separate indexes for each case.

Authors conclude that, "On the group level, on the individual physician level, and on the individual case level, all three investigations conclude that 1) good recording is related to good practice and that 2) the relationship is not perfect but it is statistically significant."

Margolis, C. Z., et. al. A graded problem oriented record to evaluate clinical performance. Pediatrics, 51:980-85, June 1973.

Purpose was to attempt to grade students' problem oriented records to measure objectivity, validity and reliability of the POR as an instrument that would evaluate achievement of objectives of data collection, data recording, and problem solving. Students in three pediatric clerkships at two medical schools participated. All students submitting POR's for grading received the same POR outline and one teaching session on its use. The POR was divided into eight major sections (chief complaint through plan) and the fourth section (medical history) was additionally divided into eight sections. A checklist was used, and each section was graded for completeness and/or structure, based on a predetermined maximum score allowed for each section. Each major section was also given from one to six extra points on the grader's subjective impressions.

Investigators conclude that the POR is valid in the sense that students write actual data they elicit with history and physical exam, however, they suggest more comparisons be made to conclude that all data recorded is elicited. They also conclude that the GPOR is adequately objective in that little variation was found among eight different graders.

The investigators also point out some limitations of the GPOR. While the problem list, plan, and interpretation may be used to measure clinical problem solving, one can't conclude that the GPOR measures clinical judgment or the ability to make decisions in a real clinical situation. Also, the GPOR does not contain certain psychological variables that routinely affect decision in clinical situations. A third limitation is that it takes an experienced grader at least 20, usually 30, minutes to grade a single write-up for the data collection and problem-solving components of clinical performance.

Richardson, F. MacD. Peer review of medical care. Medical Care, 10:29, 1972.

This study of judgments of quality of clinical care, made after retrospective analyses of hospital charts, showed that: (1) individual judges differed in degree of harshness or permissiveness of their respective judgments, (2) the judges relied on different aspects of clinical care to make final judgments regarding quality of that care, and (3) the number of independent judges required to reach stable judgment of quality of care exceeded the number logistically available to meet the probable future demands of third-party payors. Investigator suggests that such judgments should be related to compliance or noncompliance of the recorded care with pre-established sets of standards for that care.

Sibley, J.C., et al. Quality-of-care appraisal in primary care: A quantitative method. Annals of Internal Medicine, 83(1): 46-52, July 1975.

Describes method for measuring quality of clinical care provided by physicians and nurse practitioners. Three approaches used simultaneously in the method are described: (1) surveillance of the management of indicator conditions (i.e., a disease, presenting symptom, injury, a state), (2) evaluation of the clinical use of drugs, and (3) the assessment of referral decisions. Clinical records of the practice under assessment were the principal data source for the indicator conditions and drug use components, and nurses were trained to abstract information from the clinical records and to score the abstracts according to predetermined criteria. Results using the 3 approaches were consistently similar regarding the relative performances of the practices compared, and were in agreement with studies simultaneously being done regarding outcomes of care.

Ebel, Robert L. Essentials of Educational Measurement, Englewood Cliffs, New Jersey: Prentice-Hall, 1972.

This book includes a chapter on the use of true-false items in which the author discusses some of the common problems with this type of item (triviality, ambiguity, guessing, harmful effects on learning) followed by suggestions for improvement. In the chapter on use of multiple choice items, Ebel recommends that test constructors err in the direction of too few distractors rather than too many; he suggests 3 distractors as a goal to which one should aim. In order to discriminate efficiently at both ends of the score distribution, Ebel recommends difficulty levels ranging from 30 percent to 70 percent, clustering about the 50 percent level.

Feldt, Leonard S. and Forsyth, Robert A. An Examination of the Context Effect in Item Sampling, Journal of Educational Measurement, 11:2, Summer 1974.

Several factors, labeled context effects, are present under matrix sampling conditions that are not present during traditional test administration. This article attempts to determine if student performance is affected by these differences. Subjects were tested in English and mathematics under both traditional and matrix sampling conditions. Results indicate that in specific content areas one may generalize test norms from matrix sampling; however, it should not be assumed to be appropriate at all levels or in all content areas.

Gronlund, Norman E. Measurement and Evaluation in Teaching, 2nd ed. New York: Macmillan, 1971.

Gronlund states that objective test items are not limited to measurement of simple recall, but are also suitable for measuring understanding levels. Other desirable attributes of multiple choice items are their relative freedom from response sets and the use of several distractors allows easier diagnosis of reasons for incorrect responses. Disadvantages cited by Gronlund include that this assessment procedure is not well suited to measurement of problem solving skills and is inappropriate for measuring ability to organize and present ideas.

Gulliksen, Harold. Theory of Mental Tests, New York: Wiley, 1950.

This classic text presents the theory and derivation for reliability and validity coefficients and discusses the impact of item difficulties on test score distributions. Other topics of interest include effect of test length on validity and item analysis methods.

Hakstian, A. Ralph and Kansup, Wanlop. A Comparison of Several Methods of Assessing Partial Knowledge in Multiple-Choice Tests: II Testing Procedures, Journal of Education Measurement, 12:4, 231-239, Winter 1975.

Two testing methods are investigated using conventional testing procedures as a baseline for comparison. The experimental methods are (1) elimination testing in which the subjects are instructed to respond by crossing out incorrect answers and (2) confidence-testing in which subjects are instructed to distribute points to the item alternatives. The authors state that an increase in reliability and validity should be the criteria for the adoption of a new testing method. Neither of the experimental methods in this study satisfy that criteria.

Kansup, Wanlop and Hakstian, A. Ralph. A Comparison of Several Methods of Assessing Partial Knowledge in Multiple-Choice Tests: I Scoring Procedures, Journal of Educational Measurement, 12:4, 219-230, Winter 1975.

The authors investigate the relative merits of different scoring procedures applied to the same sets of responses to determine partial knowledge of multiple-choice test items. These procedures include conventional, logically weighted and confidence weighted scoring. The confidence-weighted scoring evaluates five alternative methods of calculating the weights. The authors state that there is no evidence relative to increased reliabiltiy or validity to support the use of either logically weighted or confidence weighted scoring.

Lord, Frederic M. Formula Scoring and Number-Right Scoring, Journal of Educational Measurement, 12: 7-11, Spring 1975.

The author challenges the assumption made in formula scoring that examinees either know the answer to an item or choose from distractors at random. Formula scoring is defined as the situation in which there is a scoring penalty for wrong answers. Number-right scoring is defined as no penalty for wrong answers. He suggests another assumption, that "the difference between an answer sheets obtained under formula-scoring directions. . .and the same answer sheet obtained under right scoring directions . .is only that omitted responses, if any, on the former answer sheet are replaced by random guesses on the latter." This assumption allows the test taker to validly use partial information. Lord suggests some research strategies to investigate this assumption.

Lord, Frederic M. and Novick, Melvin R. Statistical Theories of Mental Test Scores, Reading, Massachusetts: Addison-Wesley, 1974.

This text develops the theory utilized in classical measurement theory, generalizability theory, and latent trait models. A very theoretical and rigorous treatment of measurement theory.

Mehrens, William A. and Lehmann, Irvin J. Standardized Tests in Education, 2nd ed. New York: Holt, Rinehart and Winston, 1973.

While presenting a general overview of standardized tests, the authors discuss reliability, gain scores, score interpretation and practical aspects of testing.

Multiple-Choice Questions: A Close Look. Princeton, New Jersey: Educational Testing Service, 1963.

This booklet contains many examples of multiple choice items and illustrates the flexibility of the format. Suggestions are also provided on how to interpret item analysis information.

Stodola, Quentin and Stordahl, Kalmer. Basic Educational Tests and Measurements, Chicago: Science Research Associates, 1967.

This text presents an excellent introduction to writing and using classroom tests. Sections are included on measurement theory and applications of testing and are written in an elementary, easy to understand manner.

Washington, William N. and Godfrey, R. Richard. The Effectiveness of Illustrated Items, Journal of Educational Measurement, 11:2, 121-124, Summer 1974.

This study compares performance on written and illustrated items in an attempt to standardize the illustrated items. All illustrated items are categorized in terms of size and type. The authors suggest that more examination is needed to determine the relationships between those two types of items in order to establish guidelines for test item presentation formats.

ESSAYS

Chase, C. I. The impact of some obvious variables on essay test scores. Journal of Educational Measurement, 5: 315-18, 1968.

In this study, investigated problem: "What is the effect of quality of handwriting, spelling accuracy, and use of a scoring key on scores given essay test items?" Findings support conclusions that: 1) quality of handwriting has significant influence on test scores given (papers with good script are scored more generously than those with poor script), 2) spelling is not significantly related to scores, 3) scorers using a key tend to give paper more points than scorers who don't have a key, and 4) scorers grading papers with poor handwriting grade the first item about the same as scorers grading papers with good handwriting. However, scorers grade papers with good handwriting higher on the second item than the first one, while scorers grading papers with poor handwriting grade the second item lower than the first.

Ebel, Robert L. Essentials of Educational Measurement, Englewood Cliffs, N.J.: Prentice Hall, 1972. Chapter 6, The Characteristics and Uses of Essay Tests.

Suggests that essay tests can measure almost any important educational achievement. Indicates it does measure recall because recall is involved in composition of an answer to an essay test question. However, suggest essays can measure understanding and ability to apply principles, ability to think critically, ability to solve novel problems, ability to select relevant facts and principles and to integrate them toward solution of complex problems. Points out that scoring essays is time consuming and difficult. Lack of writing skill may influence scorer's judgment of content of the answer. He provides suggestions for most effective use of essay tests and for improving test questions.

Gronlund, N. E. Measurement & Evaluation in Teaching. New York, N.Y.: Macmillan Co., 1971. In Chapter 10, "Measuring Complex Achievement: The Essay Test," pp. 218-233.

Differentiates between restricted response essays (which limit both content and form of response) and extended response (where student given more freedom to develop response). Emphasizes importance of insuring that course objectives are carefully defined and essay questions be phrased so as to call forth the desired behavior. Like Ebel, suggests scoring is unreliable, and this is most serious limitation of essay tests. He provides suggestions for increasing reliability and for constructing essay tests.

Klein, S. P. and Hart, F. M. Chance and systematic factors affecting essay grades. Journal of Educational Measurement, 5: 197-206, 1968.

Lipton, A. and Huxham, G. J. Comparison of Multiple-choice and essay testing in preclinical physiology. British Journal of Medical Education, 4: 228-238, 1970.

In this study, multiple-choice and essay tests were designed primarily as achievement tests--to see if individual students had adequate factual information and comprehension of principles underlying the subject matters. Results demonstrated that multiple choice tests were more consistently reliable and valid than essays. Essay tests only became as valid as multiple-choice tests when their reliability was improved by independent marking and by allowing more time for scoring.

Medical Student Evaluation Manual: A Brief Introduction to Evaluation Techniques. Evaluation Systems Group, Dept. of Medical Education, S.I.U. School of Medicine, Dec. 1972.

Naeraa, N. Comparison of the use of EDP in essay and multiple-choice testing. British Journal Medical Education, 7: 64-6, March 1973.

Describes how electronic data processing (EDP) can be used to grade both short answer and narration type essay test questions. For short answer, graders are provided with model answers (agreed upon by at least 3 instructors) and mark sensing cards. Each response is rated from 1-6 where 3 is barely acceptable and 6 is the maximum acceptable answer. After evaluating an answer, examiner draws thick line through relevant number on mark sensing card. All cards then processed by EDP according to a program similar to that used for multiple-choice, but grades of 4 or above are considered "correct." An essay printout of results is produced--similar to a multiple-choice printout.

Procedures for narration type essays are similar except that agreement is first reached on the relevant constituent of an answer and on the weight to be assigned to each.

Page, E. B. Grading essays by computer. Phi Delta Kappan, 47: 238-43, 1966.

Article demonstrates that computer measurement of the quality of essays has been proven feasible. Attempted to imitate or s imulate a group of judges by determining correlates of true characteristics of the essay. Each intrinsic variable (variable of true interest) was correlated with an approximate variable (variable which approximates the intrinsic variable). For example, one may be interested in the complexity of a student's sentences, such as branching or dependency structures he uses. This sentence complexity is an intrinsic variable. However, computer programs now in existence are not satisfactory for measuring this variable. But an approximate for this intrinsic variable might be the proportion of prepositions or of subordinating conjunctions. This proportion might be employed in computer analysis. In a first data run, a computer program produced judgments that were practically indistinguishable from those of English teachers. Investigator suggests that in the future, the computer will be easily distinguishable from human judges because it will correlate more highly with each human judge than will the other human judges.

ORAL EXAMINATIONS

Ebel, Robert L. Essentials of Educational Measurement, Englewood Cliffs, N.J.: Prentice Hall, 1972. Chapter 10, Oral Examinations, pp. 263-269.

Suggests that the oral exam may appear to be a superior or easy solution to problems of examination. However, the proposed advantages are negated by the difficulty and unreliability of the oral exam. Ebel asserts that "it is possible to use oral examinations effectively, but it is almost always unattractively difficult to do so."

The major advantage of the oral exam according to Ebel is the personal contact aspect of the approach. However, this procedure has more limitations than advantages. Ebel provides suggestions for more effective use of the oral--to improve its reliability and validity.

Levine, H. G. & McGuire, C. H. The use of role-playing to evaluate affective skills in medicine. Journal of Medical Education, 45:700-705, Sept. 1970.

Describes an oral exam procedure which simulates doctor-patient relationship. Trained examiners play roles of patient, colleague, other health personnel, etc., and examinee plays role of physician. Role playing oral designed to measure mainly attitudes, ability to relate to patients and colleagues, although examiners also allowed to rate cognitive factors.

Levine, H. G. & McGuire, C. H. The validity and reliability of oral examinations in assessing cognitive skills in medicine. Journal of Educational Measurement, 7 (2):63-74, 1970.

Like the other articles generated by McGuire, and Levine and McGuire, suggests that many of the validity and reliability problems that plague traditional oral examinations can be minimized by structuring the examination, standardizing the case materials, training the examiners and pooling their ratings.

McGuire, C. H. The oral examination as a measurement of professional competence. Journal of Medical Education, 41:267-274, March 1966.

Findings of study suggest that the oral examination, as typically used, measures mainly recall of knowledge. Analysis of responses made by candidates for specialty certifcation during one examination session indicated that overall, 70% of their responses were classed as recall, fewer than 20% required interpretive skill, and 13% were judged to require problem-solving skill. While costly and time-consuming, investigator states that when the competence to be measured is clearly defined and when test is properly administered by specially trained examiners, the oral exam can be used to measure aspects of competence not readily measured by other techniques.

McGuire, C. H. The oral examination revisited. (Paper presented to the Conference on Oral Examinations sponsored by the Committee on the Study of Evaluation Procedures of the American Board of Medical Specialties, Chicago, March 19, 1975).

McGuire describes how the oral examination procedure used by one specialty board was "redesigned." A series of 5 oral exams were developed, 3 to test problem solving abilities, 1 to test observation and interpretive skill, and 1 role playing oral to test interpersonal skills. Two criteria were established as part of the 'revised' oral, i.e., standardized case materials were developed and used for all oral exams, and all examiners took part in a training program prior to administration of the orals. Analysis of responses made during this series of orals indicated 75% required problem solving ability, more than 1/3 of the responses required interpretive skill, and 36% of the responses were of affective behavior. Only 15% of the responses were classed as requiring recall of information.

Medical Student Evaluation Manual: A Brief Introduction to Evaluation Techniques. Evaluation Systems Group, Dept. of Medical Education, S.I.U. School of Medicine, Dec. 1972.

Provides brief discussion of several evaluation techniques, including oral examinations. Suggests that orals have advantages because they provide means to measure some aspects of competence not measured by other methods, such as ability to express oneself orally, attitudes, interactions, etc. Suggests too that if orals are used, the procedure should be standardized, i.e., examiners briefed and paired with experienced ones, desired content be outlined, and grading systems carefully planned, etc.

Pokorny, A. D. & Frazier, S. H. An evaluation of oral examinations. Journal of Medical Education, 41:28-40, Jan. 1966.

Study explores several aspects of oral examination process and procedure, particularly its validity and agreement among different examiners. Conclusion is that oral exams have many disadvantages and represent a relatively poor method for ranking students. However, orals do seem to be adequate for simple pass-fail evaluations and may even have certain advantages when used for this purpose.

VanWart, A. D. A problem-solving oral examination for family medicine. Journal of Medical Education, 49:673-680, July 1974.

Discusses use of the formal oral examination, a tightly structured problem solving exam. The candidate is more or less "in charge," and the examiner is his source of information. Preselected cases are used, and examiner provides information to candidate and then scores candidate on what he says and does. While investigator cites a number of advantages to using the oral exam, he concludes that the cost is so exorbitant that they are seeking other methods for evaluation.

SELF-ASSESSMENT AND PEER ASSESSMENT

Denehy, G. E. and Fuller, J. L. Student peer evaluation: An adjunct to preclinical laboratory evaluation. Journal of Dental Education, 38(4): 200-203, 1974.

Investigators describe a student peer evaluation system used for the psychomotor domain in a dental education program. Two groups of students provided evaluations of their peer's projects (creating a full crown wax up of a specific tooth). These evaluations were used as final scores, provided an arbitrarily established 0.75 correlation coefficient between the 2 groups was attained. Two instructors also evaluated each project. Results showed a mean correlation coefficient of 0.744 for student evaluator scores. The mean correlation between the student groups' and instructors' scores was 0.715. A follow-up attitude survey revealed that a higher percentage of student evaluators than student non-evaluators liked the peer evaluation system and felt that a combination of instructor and student evaluations would be the best means of grading.

Gronlund, N. E. Measurement and Evaluation in Teaching. New York: Macmillan Co., 1971. Chapter 17, "Evaluating Learning and Development: Peer Appraisal and Self-Report," pp. 435-465.

Points out that there are areas of student development where a teacher's evaluation of behavior needs to be supplemented by student judgments and reports. Suggests that peer ratings and student self-assessments be used. Peer ratings can provide information regarding leadership ability, concern for others, effectiveness in group work, social acceptability, etc. Self-reports can also provide evidence of student's perception of himself and how he wants others to see him. Gronlund describes several techniques which can be used to obtain peer and self appraisals.

Helfer, R. E. Peer evaluation: Its potential usefulness in medical education. British Journal of Medical Education, 6: 224-231, 1972.

A review of many studies and articles regarding aspects of peer evaluation. Specifically, article describes: 1)characteristics of a good judge of another's performance, 2) the peer rating form in terms of instrument construction, types of rating scales, erros common to most rating scales, and reliability and validity of peer evaluation instruments, and 3) applications of peer evaluation in general and medical education. Helfer cites a number of studies indicating high reliability and validity of peer evaluation. Although only a few researchers have tested their instuments, those who have, found positive correlations of 0.8 or better. Construct and concurrent validity studies have shown correlation as high as 0.90.

Kennell, J. H., Tempio, C. R. and Wile, M. C. Self-evaluation by first year medical students in a clinical science programme. British Journal of Medical Education, 7: 230-238, Dec. 1973.

A self-evaluation procedure was implemented for medical students in first-year clinical sciences. Two student-tutorial conferences were held at mid-year and end-year during which students evaluated and discussed their own performances

in such areas as interpersonal relations, professional conduct, sense of responsibility, etc. The two tutors also provided input which may reflect different or supplementary views about the student's progress. A follow-up study regarding student attitudes toward this self-evaluation experience and its impact on their professional development showed that most of the students "consider the approach worthwhile" and believe "that it influences their subsequent behavior."

Linn, B. S., et al. Performance rating scale for peer and self assessment. British Journal of Medical Education, 9(2): 98-101.

Article describes the use of a performance rating scale for peer and self assessment. Sixteen items were represented on the rating scale, and junior medical students provided ratings of themselves and a group of their peers whom they had worked with closely on ward assignments. The items on the rating scale were related to knowledge, clinical judgment, skill in relationships, etc. Findings suggested that students rate themselves lower than do their peers. Findings also suggested that peer ratings, more than self assessments, were highly related to the grading system.

Nishimoto, G. M. and Walters, R. F. A simplified method for computer-based student self-evaluation. Journal of Medical Education, 47: 487-488, June 1972.

Article describes a student-computer interactive self-evaluation system. Purpose was to make best possible use of computers in instruction while minimizing instructor preparation time. The self evaluation quizzes were used as (a) a preview of material to be covered in lecture, (b) supplement for material presently being covered in lecture, and (c) review of material previously covered. The student is provided with total number of incorrect responses, the questions missed, correct answers, and feedback comments appropriate to the incorrect responses. The instructor also receives feedback in form of periodic reports giving him frequency distribution of ansers as well as individual student's results.

Pohlmann, J. T. and Beggs, D. L. A study of the validity of self-reported measures of academic growth. Journal of Educational Measurement, 11(2): 115-119, 1974.

Investigators describe study designed to show relationship between student's self-reports and pre- and post- measures of academic growth. These measures were obtained for simple cognitive (mainly recall and recognition), complex cognitive (analysis and problem-solving) and affective (attitudinal) domains. For the self-reports, students rated themselves on 5-point scale, indicating degree of growth as a result of taking the course. The self-reported growth scale consisted of 11 items describing various educational outcomes in the cognitive and affective domains. Results of partial correlations between the self-reported growth and pre-post growth measures showed that student self-reports "are primarily sensitive to growth in student's affective orientation toward the subject matter of a course." Correlations between self-reports and pre-post measures of cognitive growth were positive, but low.

REFERENCES FOR DIRECT OBSERVATION

Barro, Arlene R. Survey and Evaluation of Approaches to Physician Performance Measurement. Journal of Medical Education, 48: 1047-93, November, 1973.

Primary considerations with respect to the dimensions of behavior being observed are completeness and relevance. Aspects of interpersonal skills are often omitted. Two methods are suggested to make the direct observation approach more effective and objective: the critical incident technique and the task analysis approach.

Denzin, Norman K. The Logic of Naturalistic Inquiry. Social Forces, 50: 166-182, December, 1971.

Denzin suggests naturalistic observation as the appropriate method to evaluate behavior in situations that cannot be tested in a traditional manner. Triangulation of observational methods is suggested as a way to increase reliability and validity. Validity is further defined as the frequency of occurrence of given behaviors across time and relevant situations. One of the major advantages cited is the integration of complex behavior allowed by direct observation.

Dowaliby, Fred J. and Andrews, Barbara J. Ratings of Clinical Competence. Summary of current activities in National Board of Medical Examiners Research Reports, 1975.

The research literature using rating scales to assess clinical competence indicates that two common problems are: 1) the difficulty in observing an individual's performance for an adequate period of time and in a variety of situations to provide valid evaluations, and 2) a general tendency to rate all individuals in a similar fashion. The authors are field testing a rating scale derived from a critical incident study and plan to study the psychometric qualities of the scale. In addition, they plan to research the effect of different item formats and variations in sequencing of response alternatives.

Harden, R. McG., Stevenson, Mary, Downie, W. Wilson, and Wilson, G.M. Assessment of Clinical Competence Using Objective Structured Examination. British Medical Journal, 447-451, February, 1975.

This article reports on a study that combined direct observation with a checklist and multiple choice examination. The process involves several "stations" through which a student rotates; at each station the student is asked to carry out a specific procedure, such as take a history or perform a specific portion of an examination. The students are tested at the following station thus minimizing cueing of relevant questions and/or examination procedures.

Hinz, Carl F., Jr. Direct Observation as a Means of Teaching and Evaluating Clinical Skills. Journal of Medical Education, 41: 150-161. February, 1966.

The author of this article points out that students appear to enjoy an evaluation method utilizing direct observation as it provides the student with immediate and comprehensive feedback on his/her performance. In addition, the method may be a more reliable assessment of skills than the traditional method of student presentation of cases which penalizes the

student who, although possessing good clinical skills, is not adept at formal presentations of findings. The author emphasized the need for adequate training of observers and utilized video-tapes for this purpose in the reported study; reliability of raters on ranking students according to performance varied between .64 and .70.

Rationales for Clinical Skill Areas - Intern and Resident Performance. Pittsburgh, Pennsylvania: American Institutes of Research, October, 1967.

One problem in evaluating an individual's behavior is determining the appropriateness of questions when performing a history of a patient and of activities when performing a physical examination of a patient. A possible solution suggested in this report is to have a physician interview and/or examine the patient prior to the student examination so that relevant questions and/or signs for intensive probing can be incorporated in a checklist to be used in evaluating the student's performance. One way suggested to supplement direct observation is to have students examine pre-selected patients with clearly indicated signs of an underlying abnormality and other patients with more subtle signs. The student is given a limited amount of time to examine the patients and records his findings and notes whether observed signs are obvious or subtle. This procedure requires no observer present during the examination.

Turner, Edward V., Helper, Malcolm M. Kriska, S.D., Singer, Standford A., and Ruma, Steven J. Evaluating Clinical Skills of Students in Pediatrics. Journal of Medical Education, 47: 959-965, December, 1972.

Pediatric residents acted as the observers to rate student performance in this study. Video-taping of the interview and physical examination was performed through a one-way mirror to minimize intrusion on the patient-physician relationship. Estimated reliability for 4 raters on seven variables designed to reflect clinical skills ranged from .55 to .92. Even with the time investment and difficulties in assessing reliability using direct observation, the authors suggest that this method is particularly useful because the experience is educational as well as evaluative for the student.